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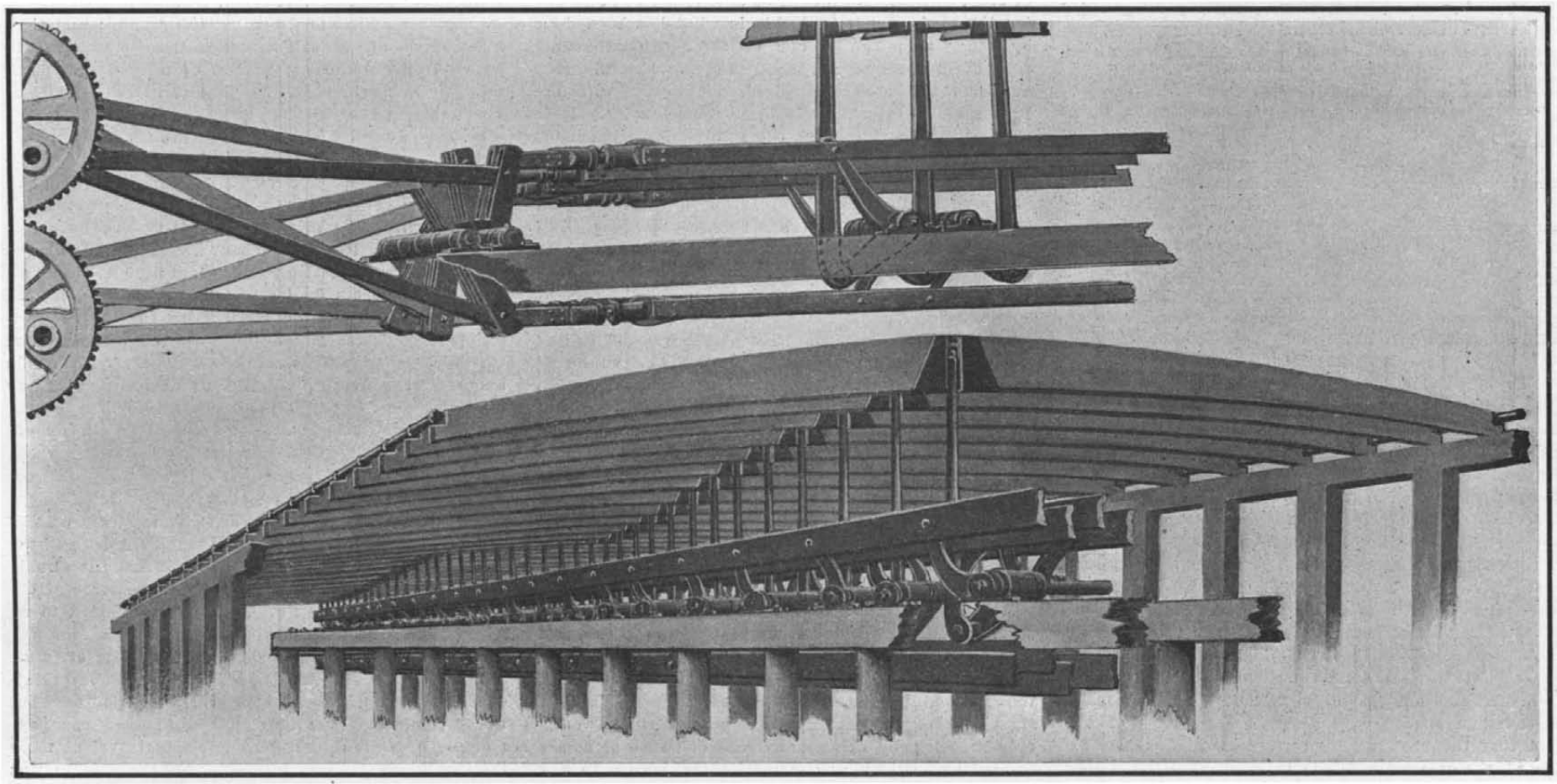

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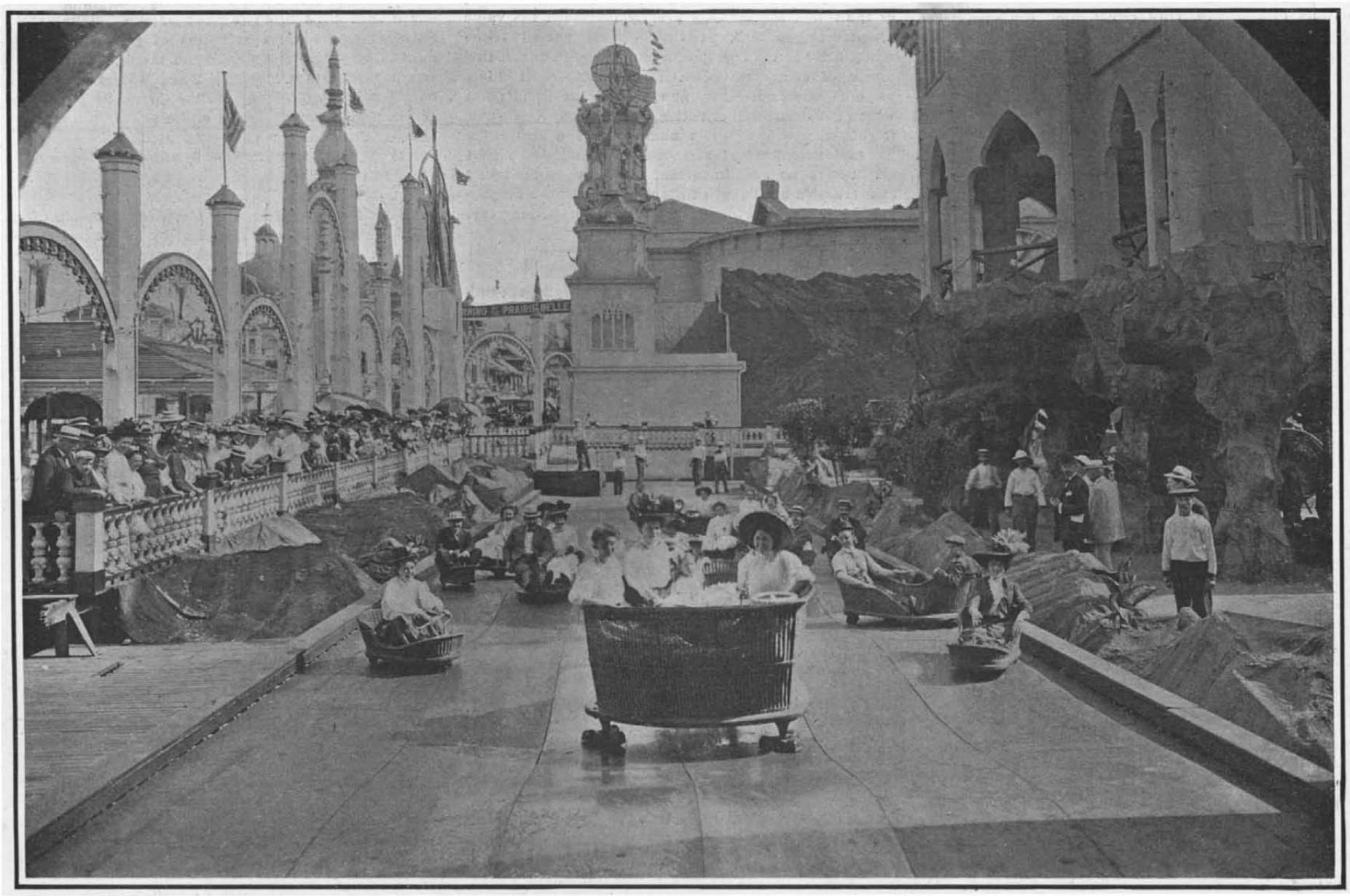

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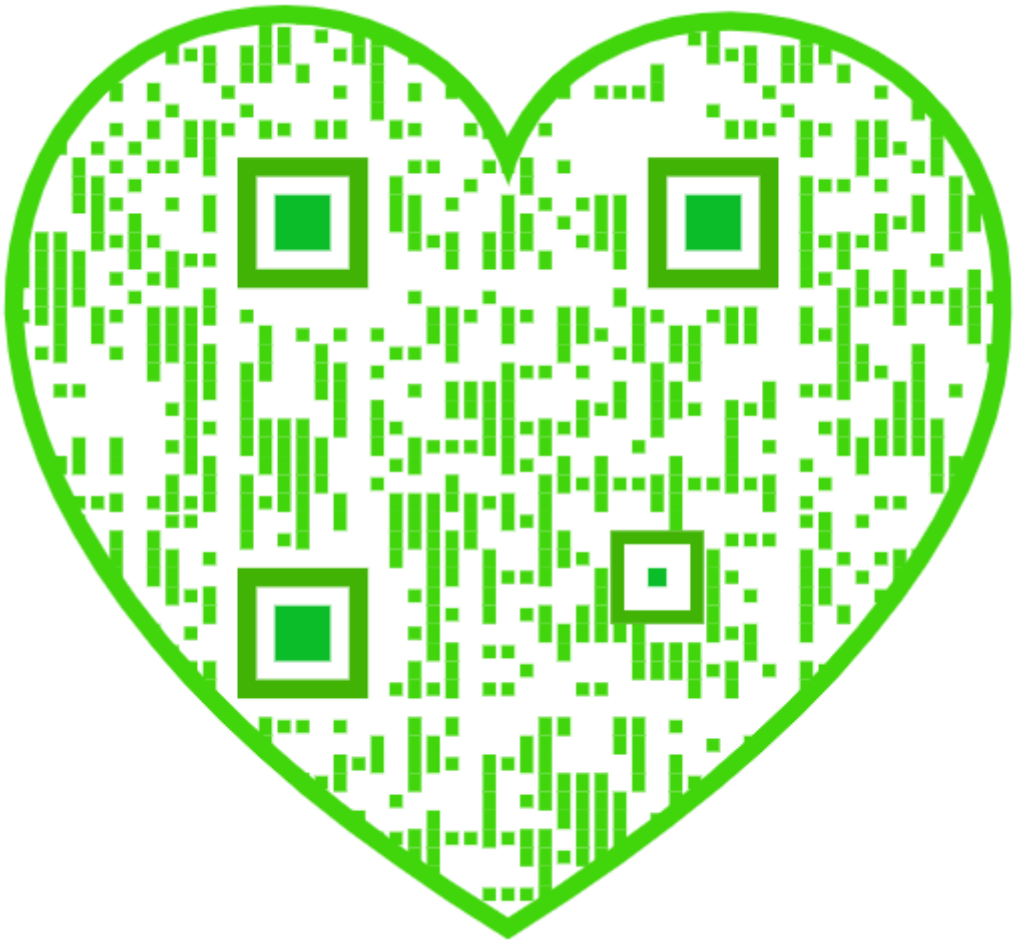
THE "WITCHING WAVES" IN LUNA PARK, CONEY ISLAND. SPORT ON A METAL SEA.—**[See page 108.]**



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NEW YORK, SATURDAY, AUGUST 15, 1908.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE SUCCESSFUL DEFENDER OF THE INTERNATIONAL MOTOR BOAT CUP.

The surprising speed shown by "Dixie II." in a series of trials over a mile course, which were held on the day succeeding her successful defense of the British International Motor Boat Cup, establishes her position as the fastest motor boat in the world. The details of her performance in the international race, when she defeated with comparative ease two boats, each of double her own horse-power, will be found on another page of this issue. With a view of determining exactly how fast "Dixie" could be driven, her owner decided to have the boat tried out on the measured 1.1-mile course of the New York Yacht Club in Hempstead Harbor, which was surveyed by the United States government for such trials. In four runs over this course, two with and two against the tide, the "Dixie II" made an average speed of 31.05 knots. In view of the fact that the boat might possibly establish a world's record, the greatest care was taken to have the timing perfectly accurate. The times were taken at one end of the course by Messrs. J. Frederick Tams and Ernest E. Lorillard of the Regatta Committee of the New York Yacht Club, and at the other end by the yachting editors of the New York Sun and of the SCIENTIFIC AMERICAN, a system of cross checks on the timing being used to eliminate any possibility of error. This fine performance marks the "Dixie" as the fastest boat of her size in the world. The best previous speed over the measured mile was made last spring by the "Wolseley-Siddeley," when she averaged 30.3 knots on the measured Admiralty mile in Stokes Bay, England.

The success of "Dixie II" proves that the race is not always to the strong; for her two competitors carried, in the case of the "Wolseley-Siddeley" two 200-horse-power engines operating twin screws, and in the case of "Daimler II" three 175-horse-power engines driving three screws. Each of the three boats is just under 40 feet in length. The English, who sought to obtain high speed by the use of big horse-power, concentrated their attention upon the engine, apparently considering the hull merely as a weight carrier; and they neglected those refinements of form which are so essential to success, particularly at the higher speeds. The American boat was designed by Clinton H. Crane, of the firm of Tams, Lemoine & Crane of this city, who decided that the chances of success would lie with the boat which embodied great refinement of form with moderate horse-power; that is to say, moderate in comparison with the enormous engines carried by the challenging boats. The lines of the "Dixie" were developed as the result of careful towing-tank investigations made at the government model basin at Washington. The hull is constructed with extremely light but carefully proportioned scantling, covered with a single skin of mahogany sheathing. The engine is of the 8-cylinder, V type, with the cylinders inclined at 45 degrees from the horizontal; and although it is capable of developing as high as 230 horse-power, its weight is but 2,150 pounds. It was designed by Mr. H. M. Crane, brother of the designer of the "Dixie II," specially for this type of boat; and its running, as observed by the writer during a short trip at 31 knots, was remarkably smooth and free from vibration. The propeller, which has been developed from experience gained with previous high-speed boats, showed in tests the high efficiency of 70 per cent. The total displacement of the boat when she ran her mile trials was only 4,700 pounds with full equipment aboard. The success of the "Dixie" is rendered the more creditable, when it is known that she had but one week available for tuning up; and her brilliant victory is to be compared in its international importance with the success which has attended the defense of that coveted trophy of the sailing yacht, the "America" cup.

A CRUISER-BATTLESHIP HOLDS THE TRANSATLANTIC RECORD.

When the "Lusitania" recently broke the transatlantic record by covering the distance from land to land at a speed of 25.01 knots, it was presumed that she had placed the figures at a mark where they would stand for many months to come. Outside of her disabled sister, the "Mauretania," there was apparently no vessel in sight that could come within several knots of that speed. Certainly, it was not for a moment supposed that a cruiser-battleship carrying an armament of eight 12-inch guns would be able to set out and better the performance; yet this is what has been done by the "Indomitable," one of three "Dreadnought" type of cruisers recently built for the British navy. The feat was accomplished on her return with the Prince of Wales from the Quebec celebration. It is claimed that on her trials the ship made 27 knots for several hours; and advantage was taken of the opportunity for a long ocean test to drive the ship under full power from land to land. The average speed of the "Indomitable" for the whole course was 25.13 knots, and for four hours in the early part of the voyage she made 26.4 knots. Incidentally, she also captured from the "Lusitania" the record for the highest single day's run to the westward, by steaming 605 knots from noon to noon. The vessel was not in any way stripped for this performance. All the heavy guns were on board, the magazines were filled with ammunition, and she carried the full equipment of active service. The best previous transatlantic trip by a warship was made by the cruiser "Drake," on her return trip from America a few years ago, when she averaged 19 knots. Our own cruiser "Columbia," more than a decade ago, established the first record of this kind by steaming from the British coast to Sandy Hook at an average speed of 18 knots.

This performance of the "Indomitable" will be hailed with delight in the camp of those naval strategists who believe in the strategic value of high speed in warships. Here, they will say, are three huge vessels of between 17,000 and 18,000 tons displacement, the "Indomitable," the "Inflexible," and the "Indefatigable," mounting among them no less than twenty-four 12-inch guns, or as many guns of that type as are carried on any six of our battleships, which, in five days' time from the date of leaving the British shores, could drop anchor off Sandy Hook. It can no longer be questioned that the great improvement in the reliability of the marine engine, due to the perfecting of the steam turbine, has greatly increased the value of speed in warships. It is conceivable that situations might arise in the course of a naval war, in which this power of concentrating a large number of high-powered, armor-piercing, guns swiftly at some point where the strategical situation of the enemy was weak, might change the whole character of a campaign. Three "Indomitables" attached to an admiral's fleet might have the same important bearing upon the issues of a season's campaign as Stonewall Jackson's swiftly-marching and hard-hitting brigade in the earlier years of the civil war.

THE ZEPPELIN AIRSHIP DISASTER.

The SCIENTIFIC AMERICAN shares sincerely in the universal sympathy which has been expressed for that indomitable inventor, Count Zeppelin, in the sudden and absolute destruction of his great airship. Although it has for many years been our conviction that, because of the great area which it exposes to the wind, the dirigible balloon is at its best a precarious means of air navigation, we have always appreciated the intelligence and courage with which the Count has persevered in his attempts to bring the practical out of the impractical. The failure is not to be set down to any lack of skill or forethought on his part; it is due rather to certain fundamental principles, which govern the whole theory of the dirigible balloon—principles which, like sunken rocks at sea, are an ever-present menace, and are liable to wreck the ship of the air with the swift and unheralded destruction which marks so many marine disasters. We refer to the fact that the very size and bulk which give to the airship its undoubted advantages of buoyancy, steadiness, and lifting power, expose this type to almost certain destruction, should it be struck by a sudden squall when it is anchored near the earth. Moreover, it is by no means certain that the dirigible, though constructed with the skill shown by Count Zeppelin in his latest airship, would be able, even if far above the earth, to stand the wrenching and twisting stresses, and the fierce vortices, which are liable to occur in a heavy windstorm.

The dimensions of the wrecked balloon have not been given out officially; but it is believed to have been something less than 450 feet in length by 45 feet in diameter. It is probable that the projected area in a longitudinal vertical plane, if we include the supporting framework, the engines, propellers, and working platform, was not far short of 18,000 square feet. Engineers, in determining the wind stresses to which bridges and tall buildings are exposed, adopt a maximum of 30 pounds to the square foot as representing the average pressure in a heavy wind storm over a large surface. The strength of the first rush of wind in a thunder storm, such as that which wrecked the Zeppelin airship, might possibly be sufficient to reach the 30-pound unit pressure, in which case the whole structure would be subjected to a broadside pressure of over 250 tons. End-on, the pressure would not be much less than 28 tons on the projected area. But even in a moderate breeze, the area is so great that the side pressure would easily amount to from 20 to 30 tons. It is evident at once that, under such conditions, the balloon, if anchored, must necessarily be swung over and dashed against the ground; and that, when in the air, even if it possessed sufficient strength to resist the distorting strains of uneven and fierce air blasts, there would be no alternative but to be blown before the gale.

Shortly after the completion of its 220-mile 12-hour flight from Lake Constance to Lake Lucerne, as described in previous issues of this journal, the Zeppelin airship "No. IV." was considerably damaged by being blown against the side of its floating shed when it was being towed out, and about a fortnight was spent in effecting repairs. On August 4, at 6:30 A. M., Count Zeppelin made his final attempt at accomplishing the 500-mile, 24-hour journey required by the German government before it would purchase the airship. The weather was propitious, and the huge air vessel made another record-breaking flight. Its objective point was Mayence, on the Rhine; and accordingly the course followed was westerly along this river to Schaffhausen and Basle and then northerly above it. About nine hours after it started, the airship descended upon an island in the Rhine at Oppenheim, some eight miles from its destination. The distance covered was about 260 miles, so that an average of 29 miles an hour had been maintained, despite the fact that the airship had stopped to perform evolutions above some of the cities it passed over. Several hours were spent in repairing the driving mechanism of one of the four propellers, and finally, about 9 P. M., the huge air craft reascended, and 1½ hours later was seen above Mayence. It started at once upon the return journey, but the 110-horse-power motor in the forward car gave trouble, thus making it impossible to travel at more than half speed. During the night, the airship was sent to an elevation of 6,000 feet, and the loss of gas occasioned by this maneuver made it necessary to land. The airship alighted without trouble at Echterdingen, near Stuttgart, and some 75 miles from Friedrichshaven, about noon on August 5, and its navigator telegraphed for extra cylinders of gas, and set his mechanics at work repairing the motor. The airship was anchored in a large field, and was guarded by a detachment of soldiers. While Count Zeppelin was at lunch at a nearby inn, a storm suddenly arose and buffeted the airship so heavily that it broke away and burst. The hydrogen ignited in some mysterious manner, and the colossal airship was quickly destroyed.

It is true that, at the present stage, the aeroplane, although its exposed area as compared with the dirigible is insignificant, is hampered by its lack of stability and the difficulty of control in strong winds. Moreover, like the dirigible, it is at present severely handicapped by the necessity for having a smooth, wide, and level space for starting or alighting. Brilliant as the work of Farman has been in France, there is a world of significance in the fact that his ascents at Brighton Beach were made only when the wind had died to a gentle zephyr. Some day, however, the problem of automatic control will have been introduced into the aeroplane. The weight per horse-power of the engine will have been even further reduced; and the speed will have been raised to such a high figure, that the aeroplane of the future will be able to rise from an area of ground of reasonable dimensions and alight upon the same, in winds of considerable strength; and, when once in the air, it will be as perfectly poised and manageable as a well-found yacht upon the water. But that time is, as yet, far removed; although the Wright brothers and Farman believe it is much nearer than the public generally suppose.

MAY A MANUFACTURER BUY A PATENT, NEVER USE IT, AND SUE FOR INFRINGEMENT?

In an infringement suit brought by the Eastern Paper Bag Company against the Continental Paper Bag Company, the question came up: Can a manufacturer buy a patent, tuck it away in a pigeon hole without ever using it, and then sue another manufacturer for infringement? It is held by the Supreme Court of the United States in an opinion written by Mr. Justice McKenna that a court of equity has full power to restrain the defendant in such a case, whether or not the complainant unreasonably withheld from the public the benefits to be derived from the invention covered by the patent.

That the decision is sound follows from a consideration of an inventor's rights under the patent laws of

this country. The inventor receives nothing from the law that he did not already possess. A patent operates merely to restrain others from making and using for a limited period what he has invented. If he so chooses, an inventor may keep his discovery to himself. He is given a monopoly by patent in order that he may be induced to disclose it. The franchise which a patent grants consists altogether in the right to exclude every one from making, using, or vending the thing patented without the permission of the patentee. If the patentee sees fit not to use his device, he has but suppressed his own. His title is exclusive. He is no more compelled to work his patent, than the owner of a piece of real estate is compelled to build a house upon it.

COLOR-BLINDNESS.

BY J. F. SPRINGER.

When you stand upon some mountain top gazing at the wonderful display of colors emblazoning the western horizon just after the fiery globe of the sun has sunk from sight, do you ever wonder whether the friend by your side sees precisely the same thing? When you see that stream of red in the sky, what does he see at the same place? Something beautiful, no doubt, and something he calls red as well as you. But is his red your red? When he points admiringly to another point of the sky, and you join in his wonder and enjoyment, is it just the same sensation that is produced in both minds? These are questions that can not be answered with certainty now, and perhaps science may never be able to do so. Still, we continually assume that what one person sees or hears or smells, another perceives—the one sensation being the duplicate of the other. And there is a very great probability that this assumption is correct or approximately so.

But John Dalton, the celebrated originator of the atomic theory, had a vivid awakening on this subject in his boyhood. While he was watching a British military display, he wondered at the comments made on the gorgeous red coats of the soldiers. When he asked wherein the color of the coats differed from that of the grass, he was answered with derision. Then he awoke to the fact that his vision was different from that of others. He was what we now term color-blind. This was a new thing then. In fact, it was the researches of this same distinguished man that attracted the attention of the scientific world to the subject. He described his own case with great minuteness and care, and compared it with other cases. Pink appeared to him by daylight nearly equivalent to sky-blue. Crimson was muddy blue.

The subject of color-blindness has attracted a great deal of attention from Dalton's time to the present. This has been due in part to the fact that colored signal lights are in common use on shipboard and in the railway service. Hence the subject has assumed a practical aspect.

It is interesting and rather curious to know that few women (less than one per cent) are color-blind. On the other hand, about three or four per cent of males have this defect of vision. Color-blind persons are not all affected in the same way. Thus Dalton was red-blind, while Prof. Nagel of Germany, one of the principal investigators of this subject at the present time, is green-blind. These are instances of the two great classes constituting well nigh the whole number of those affected. There are in addition a very few cases of violet blindness and total color-blindness. Persons blind to one fundamental color are technically called *dichromats*. Those who have no color sense, but perceive merely differences of shading, are called *monochromats*.

There are numerous methods of testing for color-blindness. One of the most popular is the Holmgren test. In accordance with this method, the subject has placed before him a large number of skeins of worsted colored a great variety of shades. The person being examined is requested to sort the shades, placing those belonging to a dominant color together. If he is a typical red-blind person, he will put the red shades with the grays, unless they contain more or less yellow. The greens he will put with the yellows, unless they contain blue. If he is green-blind, he may be expected to have a tendency to put the greens with the grays and the reds with the yellows.

Such persons are evidently unfit for an engineer's position in the railway service. The railways accordingly seek men without these defects.

The subject is of importance to the traveler because the night signal for danger is a red light, and that for caution is a green one. As an engineer has a number of duties to perform in addition to watching for signals, and as the signals, moreover, may appear under very unfavorable circumstances, it would seem to be the greatest of follies to put in charge of the engine a man who doesn't know red or doesn't know green when he sees it.

But is it enough merely to eliminate the man who is distinctly color-blind? Prof. Nagel has called attention in a very emphatic manner to the unsuitability of a class of persons intermediate between the normal and the color-blind. These would be able to pass the usual tests. At the same time, under unfavorable circumstances they are liable to make mistakes in distinguishing colors. Some of these unfavorable circumstances are precisely those which occur in practical railroading. Thus a very faint light or a number of differently colored lights shown simultaneously lead to errors. And even when the correct decision is ultimately reached, there is frequently so much vacillation and hesitation that the swift and unhesitant decision that may become necessary at any moment in the engineer's cab is something not to be depended upon. These abnormals (or color-weak persons) should not be employed in a position where lives may be lost through their inability to read the signals with quickness and certainty. In fact, when we consider that signals must often be read through smoke and rain, or hail, or snow, or mist, and that they are often obscured through discolored glasses and on account of dimly-burning flames, we feel that none but the very best of normal eyes should look through the windows of a cab.

However, Prof. Nagel has not left this matter of the unfitness of the abnormals to academic discussion. He has designed and carried out a number of experiments upon color-weak persons, and has reached pretty conclusive results. The experiments referred to were performed in the laboratory. The subjects were allowed all the time they wished, so that they may be regarded as having been favored by the fact that they were tested indoors. Their errors must be looked on as a minimum. That is to say, if they had been upon the road in actual service, the mistakes would probably have been more. The subjoined table represents

EXPERIMENTS UPON THREE ABNORMALS (COLOR-WEAK PERSONS).

Experiment 12, Subject: K. (Red-Abnormal.)		Experiment 15, Subject: S. (Red-Abnormal.)		Experiment 14, Subject: Dr. A. (Green-Abnormal.)	
Shown.	Named.	Shown.	Named.	Shown.	Named.
w 2	w	.. ..	....	.. ..	.....
r 2	r	r3 r4 w3′	r? r? g	g3	w
r 3	r	w3 g4 g3	r w(g) w(g)	w5′	w
g 3	g	g6 w6′ r3	g w r	r3′	r
g 2	g	r6 r6 w3	r r g	g2	g
w 1	w	r5 r3″ r6	r g r	g4′	g
r 4″	r	g6 g3″ g6	g g g	g6″	w
r 2″	(r?)g	w2 r3 w6	? r w	r6″	r
g 1	g	w4 r6 w6″	g r g	w5″	r(w)
r 2	r	w2 w6 w6	? w w	g3	r
r3 w3 r3′	r w g	r4 r2′ r6	r g r	g3′	r
r2 w2 r2	r(g) w g(r)	r6 r2′ r6	r g r	w3″	g
r2 w1 r2	r g r	r 2	r?	w3′ r4 r5	g w w
g 1′	g	g 6	g	w3 w5 w6′	g g w
w3″ r3 r3	g r g	g 5′	g?	r3 r5′ r6′	r r r
r3 w3″ r3	r g g	r 2	r	r3 w5 r6	r g r
w3 w3″ w3	w r w	w 4′	(w, r?)	r6 w6″ r6	w g r
g3 r3″ g2	w r g	w 2′	(w, g?)	r6 r3″ r6	r g r
r6 w3″ r5	(w)r g r	w 3	r	.....	....
w3 r3 r5	r w r	....	....	.	.....
w3″ r3 r5	g r (g)r	....	....	.....	.....
w3″ r3 r5	g r (g)r	....	....	.....	.....
w6 r6 g6	g r g	....	....	.	.....
w 6	w	....	....	.....	.....
w 6″	g	....	....	.....	.....

three different experiments. The letters *w*, *r*, *g* represent the three railway colors, white, red, and green. The figures placed after the letters represent openings of six different sizes through which the lights were shown. The sizes varied from 1 to 6 millimeters in diameter. The object of this was to imitate the conditions of lights placed at various distances. The marks ′ and ″ are to be taken as indicating the insertion of one and two ground glass screens for the purpose of dimming the lights.

It will be noticed in experiment No. 12 that the subject actually pronounced a red light (*r2″*) to be green, although a single light at a time was shown. Looking at the single exposures of experiment No. 15, it will be noticed that the subject seemed to waver a great deal, and even pronounced a white light (*w3*) to be red. In the single lights of experiment No. 14, there are a number of positive errors. Observe next the cases in all three experiments where three lights were shown simultaneously, and it will be seen that errors are quite numerous. It should be borne in mind that these persons were not color-blind, but merely color-weak.

Prof. Stratton of the Johns Hopkins University has been bringing a pretty strong indictment against the lights themselves, even in the case of the normal eye. Thus, the light of safety is the so-called white light; that is, the ordinary house light uncolored. When such lights are out at locations on the road where they should be burning, the engineer should suspect something wrong. As this light is precisely the same as that used for ordinary household purposes, there is always present the danger that the safety light may in reality be out, but the engineer may think it is burning and that consequently all is clear because he sees some other light which in reality has nothing to do with the railway service. This is not merely a theoretical objection. Several cases of wrecks are cited due to this cause.

The green light—warning to be cautious—is very susceptible to smoke. This constant incident of railroads has the effect of rendering green lights pale and sickly. They are then liable to be mistaken for white; that is, for a safety signal. The point is obvious.

The objections against the red light are peculiarly weighty. This is the danger signal. Accordingly, there should be nothing weak or uncertain about its note of warning. The color itself is good. When brilliant, it is very effective. But, in order to get a red light, a piece of red glass is placed in front of a colorless light. The red glass arrests all the rays from the colorless flame except the red ones. These it permits to pass through. And thus the light appears to shine with a red glow. But this effect has been secured at the expense of a great loss of intensity. The rays which have been stopped and not allowed to pass are of course ineffectual in acting upon the eye. Only a remnant (that is to say, the red rays) of the light proceeding from the flame actually reach the eye. It is calculated that the intensity should be about one-fifth. But actual tests show that the red was weaker than even this paltry amount. Apparently, the tests have been made with lights barely able to be discerned. Outside, where smoke favored the red, it was found necessary to increase the red to about fourteen times the intensity of the white light in order to render it visible, and in the laboratory, to about eighteen times. But these are best results. On the average, about thirty to one is the ratio.

Prof. Stratton advocates discarding the color system in favor of signaling by a *movement* of the light, or by showing signal lights which depend upon their form for their significance. The suggestion is made in connection with the latter to use the horizontal, the slant, and the vertical lines. With incandescent lines of considerable length and marked intensity. this would seem to yield a capital system.

MILITARY BALLOONING IN JAPAN.

It is well known that up to the time of the Russo-Japanese war, military ballooning was organized in a somewhat rudimentary fashion in the Japanese army. During the siege of Port Arthur the two adversaries made a frequent and successful use of strategic observations which were carried out in balloons. It appears that Japan is to take up the question of military ballooning from now on, recognizing the great services which this will render for the army, and the latter will no doubt be equipped with an aerostatic corps analogous to the ones which the other leading armies employ. A special commission was sent not long since from Japan to Europe in order to observe the organization and material of the different armies and to become familiar with the different features of ascensions and handling of balloons. At present this commission is in Germany, where it has been for some time past. It has already purchased two balloons in that country, and these will no doubt be employed for military use rather than for sporting purposes, although the latter may also find a development in Japan before long.

THE CURRENT SUPPLEMENT.

A graphic account of a trip in the Zeppelin airship opens the current SUPPLEMENT, No. 1702. A system of storing and distributing benzine and other inflammable liquids without danger of explosion is described. William O. Webber writes on the comparative costs of gasoline, gas, steam, and electricity for small powers. "New Forms of Steel for New Uses" is a review by R. B. Woodworth of the development of structural shapes rendered necessary by the increasing use of steel for building. In an article entitled "Weight of Marine Turbines" some new and valuable information is given. The fact that ozone is an efficient destroyer of odors of every kind is generally recognized. Ozone is employed extensively in Germany for purifying the air of rooms. Dr. G. Erlwein, to whom credit for the German system is largely due, contributes an article on the subject which will prove most interesting to American ventilating engineers. W. F. Stanley's excellent paper on Prehistoric Man is concluded. June 19, 1907, a new phenomenon disclosed itself in the Saturnian ring system. Prof. Percival Lowell describes the phenomenon under the title "The Tores of Saturn."

Attention is again called to the approaching meeting of the First International Congress for the Repression of Adulteration of Alimentary and Pharmaceutical Products to be held in Geneva on September 8, 1908. A large number of members from the United States have already joined, but it is desirable to have the largest representation possible from this country. The congress is held under the auspices of the White Cross Society and the Swiss government. The fee for membership is $4. Dr. H. W. Wiley, of Washington, D. C., chairman of the American committee, will undertake to forward names of members and their subscription. Reduced rates will be given on steamship lines and on European railroads. Information will be sent by Dr. Wiley to all persons who desire to be apprised regarding the details of the congress. Intending members are urged to send in their subscription at once.

A MUNICIPAL "MICROBE FARM."

BY HAROLD J. SHEPSTONE.

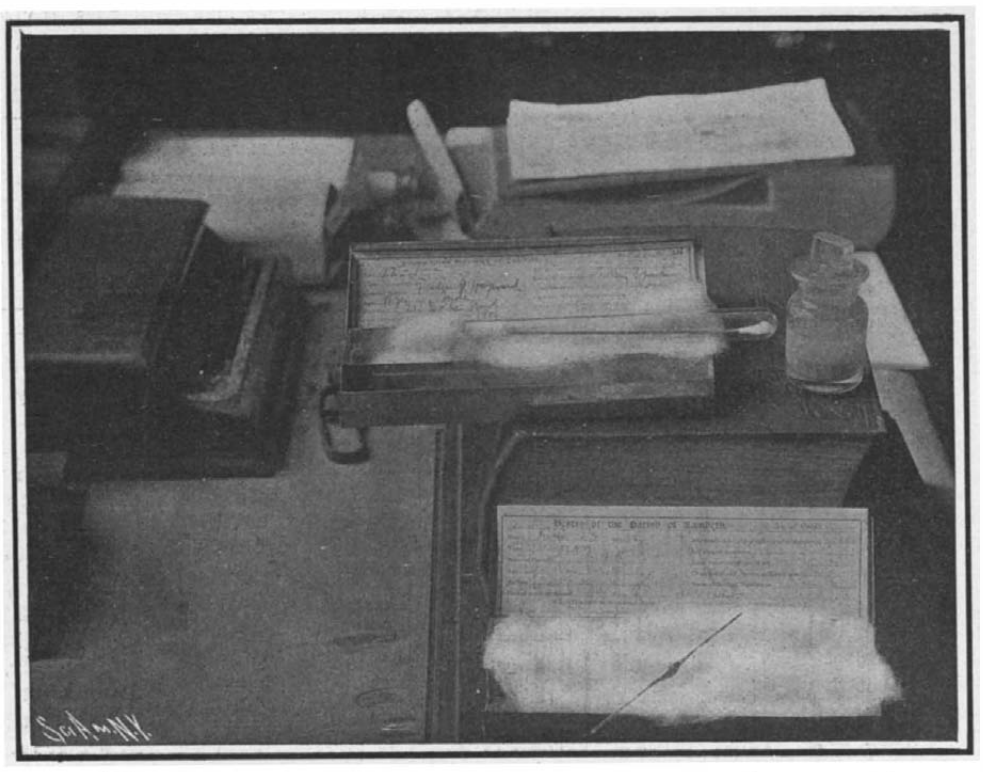
What has come to be known as London's Municipal "Microbe Farm" is an up-to-date bacteriological laboratory, situated in the center of the Borough of Lambeth. It was established some six years ago by Dr. Joseph Priestley, the medical officer of the district, and the report of its work just issued has called Londoners' attention to this interesting institution. Strictly speaking, of course, no sanitary administration can be regarded as complete without institutions of this kind, but the value of an up-to-date bacteriological laboratory, presided over by a competent chief, and possessed of the latest scientific appliances, is at once apparent after a study of the report, and a brief *résumé* of the work and methods of this institution cannot fail therefore to be of interest.

When a doctor is at all doubtful as to the nature of the disease his patient is suffering from, he sends a drop of blood, or a piece of membrane, or some sputum from the invalid to the institution. If the patient be suffering from any dangerous disease, this blood, or membrane, or sputum will contain the germs of it. Dr. Priestley examines the suspected matter under the microscope, and if it contains the bacteria they are promptly recognized, and the doctor is within a few hours informed without any possibility of mistake exactly what his patient is suffering from.

The laboratory, which consists of a large room, is fitted up with due regard to aseptic principles, and all dust, as far as practicable, excluded therefrom. The tables are covered with hard teak, and the water supply is passed through a Chamberlain-Pasteur filter. The incubator in which the germs are cultivated and isolated is of the Hearson pattern, consisting of a box of copper with double walls, the intervening space being filled with water, and the outside covered with wood and felt to prevent the conduction of heat. In appearance it resembles a safe. The water between the walls is heated by an ordinary gas burner.

The incubator is the most important outfit in connection with the laboratory, for micro-organisms under observation have to be grown on certain suitable foods, or nutrient media as they are called. To make sure that this is done carefully, they must be grown at a constant temperature. The different foods, or nutrient media, in use vary with the micro-organisms to be grown, and require careful preparation. Thus, the commonest form may be popularly described as a beef broth, and this constitutes the basis of most of the nutrient media in general use, which are prepared by mixing this beef broth with other substances, such as peptone, glycerine, grape sugar, common salt, beer wort, together with an admixture of gelatine or agar-agar for solidifying purposes—the latter (agar-agar) being used where the temperature required for the micro-organism is 37 deg. C., the former (gelatine) remaining solid only at temperature below 22 deg. C.

This beef broth is an infusion of meat, usually beef, and is prepared by taking a certain quantity of rump steak, free from fat, chopping it very fine, or mincing it, adding a certain quantity of water, and allowing it to simmer in a saucepan or *bain-marie* for an hour, cooling it, removing any solidified fat that may rise to the surface, and afterward filtering it through filter paper into a clean flask. The flask is then plugged with cotton wool, placed in its neck, and submitted to the action of steam for about one hour on two successive days, so as to sterilize it thoroughly. A stock of this beef broth is kept to be used in small quantities, as required, for the preparation of the commoner forms of nutrient media. In place of beef, veal is sometimes used, being powdered with flour, and the infusion afterward clarified with white of egg. This veal broth, when mixed with a small proportion of glycerine, is found to be specially useful for the growing of the germ of consumption.



Specimens Sent to the Laboratory for Examination.

Other nutrient media employed are milk, sliced potato, blood serum, and other fluids obtained from the human body in health and disease, eggs, etc. By means of these various foods, or nutrient media, different micro-organisms can be grown, and their life histories in that way studied. For this purpose test tubes, or plates, are generally used, into which is placed a certain quantity of the particular food or medium needed. Further, it is, at times, necessary to grow the micro-organisms on their media (a) in oxygen, (b) without oxygen, (c) in an atmosphere of carbonic acid, (d) *in vacuo*, or (e) in the presence of very small quantities, or traces, of different chemicals, etc. The laboratory also boasts of a hot-air oven, a steam sterilizer, and a number of exceedingly powerful microscopes.

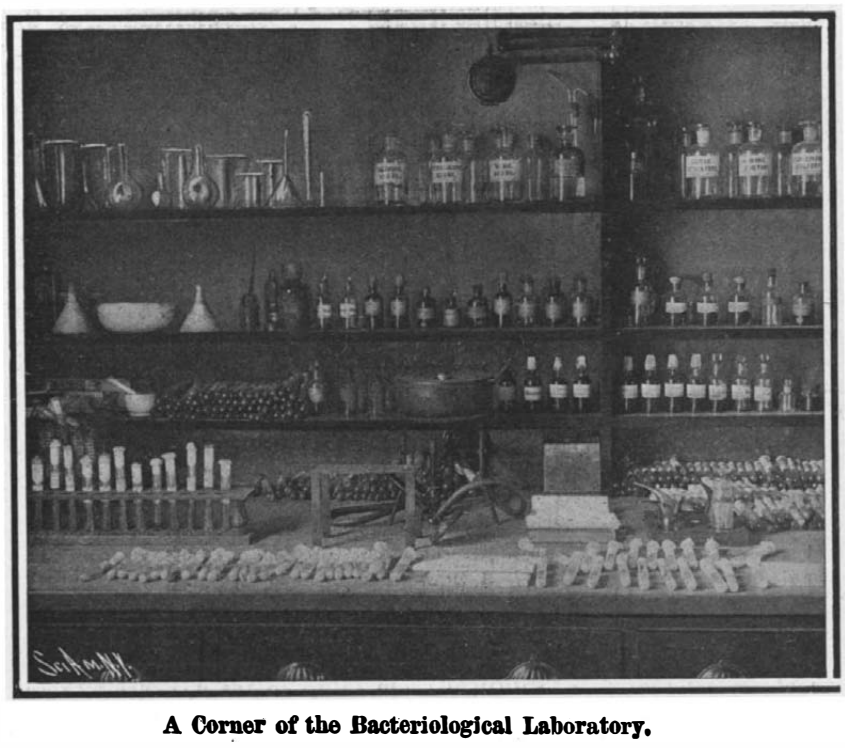
The institution has done much to improve the health of the borough, and has undoubtedly been the means of saving many lives. For instance, during an outbreak of typhoid fever, tests showed that many people were suffering from the disease who did not display the ordinary symptoms. By sending these cases into hospital the doctors were able to stamp out the outbreak, whereas had the victims not been discovered they might have helped to spread the disease. Consumption has also been discovered in its earliest stages and checked. Diphtheritic victims have been discovered in the same way, and, strange to say, several supposed diphtheria patients were prevented from going into the hospital; for microscopic examination showed that the diagnosis was mistaken, and the patients were not suffering from the disease.

One of the most interesting discoveries made at the institution showed that some children in the borough were infected with a skin disease through some mice in the house in which they lived. This was proved by microscopic examination of the skins of the children and the skins of the mice. The doctor advised the people to get a cat to destroy the diseased mice, and then the virulence of the germs was shown in the most extraordinary fashion. The cat, through eating the mice, contracted the same skin disease that had affected the mice and the children, and had to be destroyed.

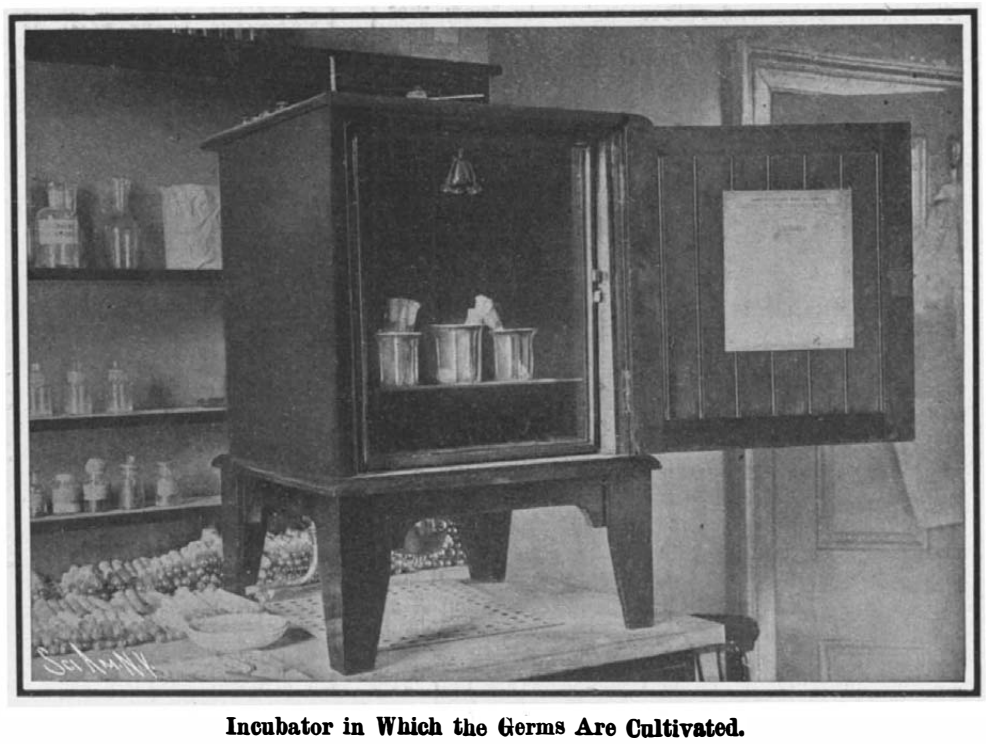
Dr. Priestley is now conducting some experiments with the germs of typhoid. He is drying them up, and then, after several months, will endeavor to revive them. In this way he will show the danger of germ-laden dust, which may lie about in an old house for years, and then infect people with disease.

Up to date over 5,000 examinations have been conducted with doubtful cases of consumption, typhoid fever, and suspected diphtheria, or for the purpose of proving the bacteriological composition of such foods as milk, ice cream, etc. This number gives a yearly average of about 700, or a daily average of two examinations since the opening of the laboratory. Before the laboratory was established the death rate in the borough was eighteen per thousand; to-day it is less than fourteen per thousand. It is interesting in conclusion to note that the "microbe farm" is practically self-supporting, only costing the borough council $250 a year for rent and gas.

The substitution of a cheap and indestructible material for timber used in mines is a problem which sooner or later will come forcibly before mine owners and engineers. Experiments have been carried on in England with reinforced concrete beams, which point to the possibility of using this material largely as a substitute for wood, especially for work which is intended to be of a relatively permanent nature, and in which the increased cost of the concrete beam is justified by its indestructibility and freedom from decay. As the cost of Portland cement tends to fall, while that of timber rises, it is, says the Times Engineering Supplement, only a question of time when concrete will become a very effective means of construction for mining operations. In this country, at the present time, reinforced concrete beams are manufactured and sold for mining purposes in the mining districts of Colorado.



A Corner of the Bacteriological Laboratory.



Incubator in Which the Germs Are Cultivated.

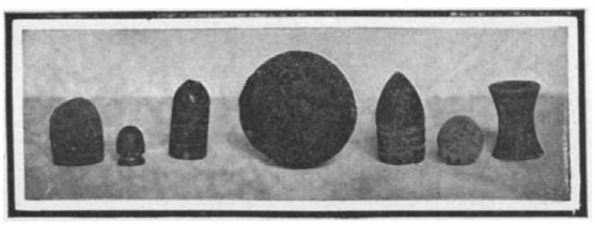
A MUNICIPAL "MICROBE FARM."

THE EVOLUTION OF THE BLOW.

BY PERCY COLLINS.

That the twentieth century man remains a fighting animal is a fact which, while many of us deplore it, none can deny. Prompted by greed, by the necessity for self-defense, or by a laudable desire to protect the weak and oppressed, he is ever ready, as of yore, to take up arms against his fellow man. Thus, it is not surprising that his inventive faculty is as active in

The Fist Was the First Striking Weapon of Primitive Man.



The Evolution of the Bullet.

the cause of war as in the cause of peaceful progress. While our day has seen the multiplication of labor-saving machinery, and of ways and means whereby the necessities and luxuries of life are rendered more perfect of their kind, and more readily accessible to all classes of society, it has also seen the engines of warfare brought to a state of perfection which, fifty years ago, was undreamed of by even the most wildly imaginative experts.

But in the science of war and weapons, as in all other spheres of human activity, the contemplative mind cannot fail to realize that the path of progress is not marked by a series of isolated inspirations, but proceeds logically—by an unemotional sequence—from a single parent idea. In other words, the devices of primitive man are the forms out of which all subsequent expedients arise. Desire or necessity inspired the untutored savage to do certain things in certain ways, thus meeting the primitive needs which arose in his life. By these means were laid the foundations of all subsequent inventions and contrivances.

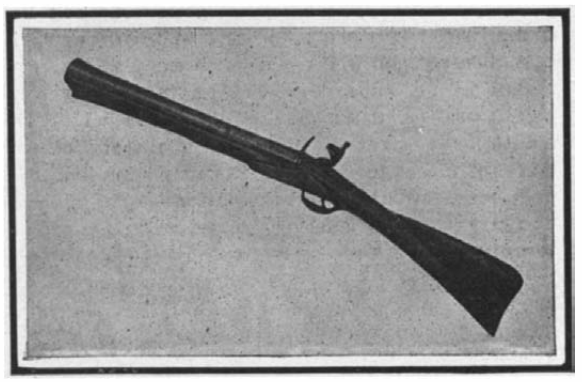
We have said that this is apparent in the science of war and weapons; nor is it necessary to evoke past history in order that we may perceive the evolutionary process through which the power to deal an effective blow has been brought to its present perfection. The living races of mankind supply us with every link in the chain. Every collector of savage weapons, every museum of ethnology, can show specimens which are, as it were, finger posts pointing to the most elaborate developments of modern times.

At first man's method of warfare was as primitive as that employed by the lower animals. He made use of what Nature had given him; that is, his fists. Clenched together, with the bony prominence of the knuckles outward and a strong arm behind, the fist can deal a very effective blow at close quarters. But man cannot long have depended solely upon his fists as weapons. It is certain that at a very early period of his history he began to make use of the objects that he found around him; and to-day no tribe or race is so unsophisticated as not to carry at least some form of club into its battles.

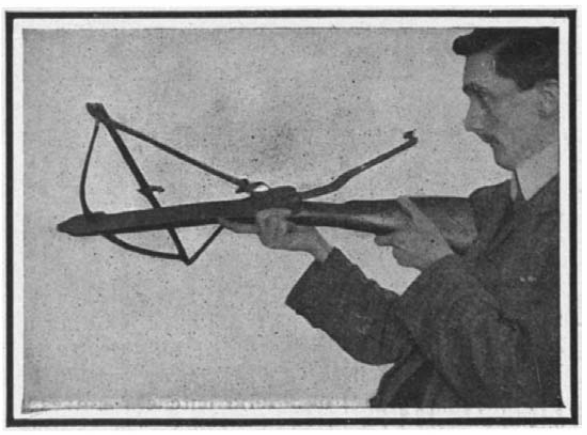
In the first place, doubtless, man in search of a weapon picked up a stone; and when he did so, he at once found himself in possession of a choice of attack. Either he could retain the stone in his hand, and with it deal a much more effective blow than was possible with his unaided fists, or he could hurl it at his approaching adversary, and thus—if his aim were true—avoid the risk attendant upon an encounter at close quarters. In fact, when the first man picked up the first stone, he did something very much more important than he can have realized at the time. He took the first step in that long march which has led him in these latter days to the rifle, the quick-firing gun, the torpedo tube with its deadly projectile.

But we must not anticipate. Let us, for the moment, fix our attention upon the man with the stone in his hand. We will ignore for the present the possibilities which present themselves if he should elect to throw it, and imagine that he makes use of it to add weight and power to his blow. He thus makes his hand into a kind of club. Notice, however, that he does so at considerable inconvenience to himself. His stone, if brought into contact with a hard body—such as the skull of his adversary—will be likely to injure the palm of his own hand. Thus, it cannot have been long ere man's attention was directed to the imperfections of the grasped stone as a weapon, and his intelligence stimulated to devise something more serviceable.

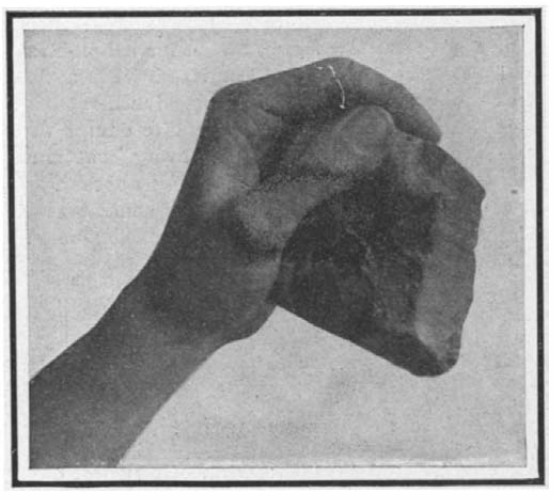
So the idea which originated in his mind when he first grasped a stone became amplified; and the savage warrior evolved the club, which of all true weapons is probably entitled to be considered the most primitive. Originally, it took the form of a heavy stick; but the discovery was soon made that a knobbed and weighted extremity added to the power and deadliness of the blow; and on this principle all the many varieties of the club have been designed. The early forms are simply the root stocks, with part of the trunks, of small trees, such as would demand both hands for their use. But there are also smaller, single-handed clubs as well; and between these extremes, almost every conceivable variety of club has been made and used. Space will not permit us to deal adequately with the club, but some of the more important varie-



The Eighteenth Century Flint-Lock.



The Arbalist, or Crossbow.

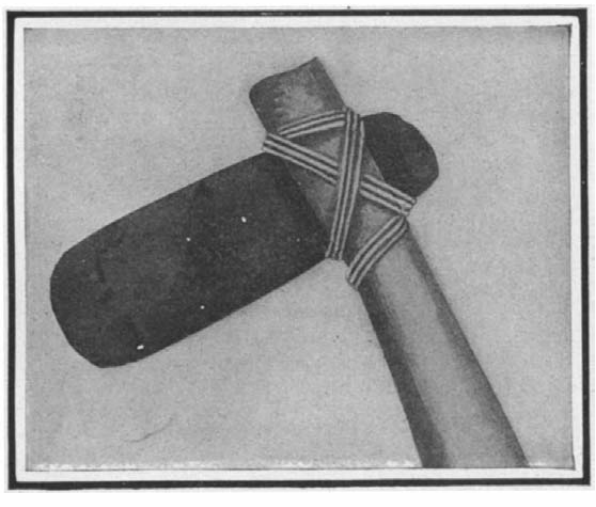


The First Step of the Evolution of the Blow Was When Man Took a Stone in His Hand.

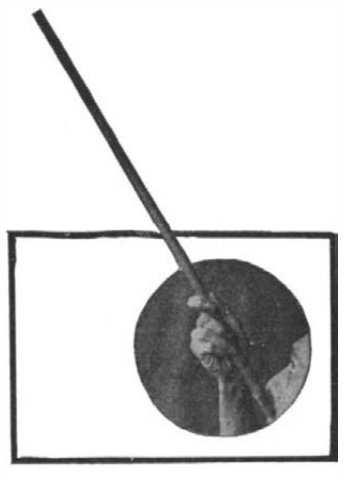
A West African Throwing Club.

A Powder-Horn of the Eighteenth Century.

The Australian Boomerang.



A Blade, Attached to a Club, Became the Tomahawk.



The Blow-Pipe of the Savage May Be Termed the Genesis of the Rifle.

The Polynesian Paddle Club Which Will Bruise, Cut or Pierce.

A Fiji Double-Hand Club; Made from the Root and Trunk of a Sapling.

THE EVOLUTION OF THE BLOW.

ties must be mentioned, as it is to be regarded as the primal ancestor of every other form of weapon.

The men of the "stone age" used clubs weighted by means of an attached stone—the stone being either pierced and wedged upon a wooden haft, or else strapped there with strips of rawhide or the sinews of animals killed in the chase. Thus, we have the stone tomahawk, or primitive battle-ax, modifications of which are still in use among savage tribes. The Polynesians, or Vikings of the tropics, who were exploring the Pacific Ocean in their canoes as early as the seventeenth century, have developed an interesting series of weapons known as "paddle clubs," in which they seem to have summed up the whole story of their method of going to war. As the name implies, these weapons are an obvious combination of the club and the canoe paddle. In other words, they are paddles made unusually heavy, and often carved into knobbed prominences. With them the deadliest blow can be dealt, while, should occasion arise, they can be equally well employed in getting a canoe out of danger, or into closer contact with the enemy.

Weapons may be classed, for convenience, under three heads, according to their character and application, viz.: Blunt weapons for bruising, edged weapons for cutting, pointed weapons for piercing. But in practice these arbitrary distinctions do not hold good, for it frequently happens that a single weapon possesses two, or even all three characteristics. For example, there is the saber bayonet, which may be used in many ways. Moreover, as we have already said, there can be little doubt that all weapons had their origin in the club; and in the American area the club is a compound weapon for bruising, gashing, and piercing in a most dreadful manner. Mexican specimens are heavy sticks grooved along the side for the insertion of blades of obsidian—that is, volcanic glass. The Sioux club is a flat piece of wood, curving and widening away from the grip, and terminating in a spherical head, which in modern times carries a long spike, while the blades of several butchers' knives are commonly inserted along the margin. The National Museum of the United States possesses a great variety of these shocking weapons, designed, as the frontiersmen say, to "knock down the white man and then to brain him and cut him into mince-meat." The Kingsmill Islanders, and other Polynesians, make dreadful slashing weapons by securing rows of sharks' teeth along a haft of wood. These weapons vary from a few inches to sixteen feet in length; and it has been said that in all the range of weapons devised by mankind, there is nothing more blood-curdling to behold. They possess considerable interest, moreover, as showing how the sword may have been evolved from the club, even by tribes unacquainted with the use of metals. African weapons, again, are exceedingly complicated, owing to the acquaintance of the natives with iron. The standard club is converted into a sort of tomahawk by the addition of blades, or into a primitive spear by the addition of a sharp spud. In fact, the plain clubs in the African area are used chiefly for throwing.

The above remarks, though brief, will suffice to convince the reader of the fact that from the primitive idea of the club were evolved the more perfect forms of the spear, the dagger, and the sword. The small knobbed clubs, or "kerries," such as are found among the Kaffirs and other African tribes, bring us to another phase of the subject; for these, while they may be employed as ordinary clubs at close quarters, are generally used as missiles. In them, indeed, we see the further development of the idea which originated in the mind of the man who first threw a stone. And here the reader must be reminded that whereas the club proper was soon brought to perfection among savage tribes, and was long ago abandoned as a weapon of civilized warfare, the missile—typified by the thrown clubs or "kerries"—is still being improved upon.

In tracing the development of the blow as dealt with a missile, mention must be made of the boomerang—perhaps the most remarkable of all savage weapons, especially when we remember that it was invented by the aborigines of Australia, the lowest and most degraded type of humanity known. The boomerang is a curiously curved piece of wood, varying in length from fifteen inches to three and a half feet. It is shaped with a view to securing the utmost steadiness and buoyancy in flight; while in the hands of a skillful thrower it can not only be made to deal a most deadly blow, but to follow a course which appears to the onlooker to be opposed to the laws of Nature, ultimately falling at the thrower's feet. Yet the boomerang, upon which much careful labor has been expended, seems to the uninitiated to be merely a piece of crooked stick.

Turning from the thrown club, of which the boomerang is the most perfect form, we come to missiles ejected by means of mechanical contrivances. The most primitive of these are the sling and the throwing stick, which latter is found in Australia, Melanesia, and in America from Point Barrow to the Argentine. Slings are in use to-day in many parts of the world, their principle being the conversion of circular motion into rectilinear motion, thus adding momentum to muscular force. But in the case of the sling it is obvious that the force of the blow will be limited by the muscular capacity of the individual warrior. The same applies, but in a less degree, to the bow—another device whereby the pent-up energy of wood, animal substance, or metal is converted into rectilinear motion and employed to convey the missile, which may be either blunt or pointed, to a distance. The same principle is involved in those gigantic engines of ancient warfare known as catapults, by means of which javelins or blocks of stone were hurled at the enemy.

It is the blow-tube of the savage, however, which is really the legitimate prototype of our modern gun. It converts the elasticity of compressed air into rectilinear motion. From it, by means of blasts of air from his lungs, the savage expels slugs or darts. But with the invention of gunpowder it became possible for civilized man to employ blasts of gas in the same manner in which the savage had used his pent-up breath. Early types of guns were made of wood wrapped in folds of linen and secured with iron hoops. Later came the various forms of arquebuse—the early examples of which were so heavy that they had to be rested upon a support when they were fired. All early types of gun were widest at the muzzle—this, too, being a pronounced characteristic of the primitive blunderbuss. But gradually the barrel assumed a more cylindrical shape, until in the eighteenth century a fairly handy, flint-lock weapon, such as is seen in the accompanying photograph, was obtained. In like manner, heavy guns, or cannon, passed through many strange forms ere they came to resemble, even in a remote degree, our modern ordnance.

All this time the bow and arrow and the arbalest, or cross-bow, were rivals of the gun. The latter, as is well known, attained a high standard of perfection, and was at one time extensively employed both in warfare and in the chase. But these weapons were destined to be discarded by highly civilized mankind, and to-day they are known to us only as curious relics of the past.

The gun, on the other hand, has continued to advance. Breech loading, by means of cartridges, has taken the place of muzzle loading by means of a powder flask and ramrod. The percussion cap, in one form or another, is found instead of the old flint-lock attachment, whereby a spark was struck upon the priming of powder. Equally numerous are the changes which have taken place in the missile itself. The early bullets were of stone and more or less circular in shape. Then came metal bullets—either of lead or iron; and later the form began to vary, in obedience to the will of mankind, until it reached the cone shape of the present day.

In the limit of a short article, the story of the blow can be told only in the briefest possible way. To deal with it fully would call for a bulky volume. Enough has been said, however, to show the romantic interest which attaches to the subject, and to show that the most perfect weapons of civilization are really the direct outcome of a single idea which, in the first instance, formulated itself in the mind of primitive man.

Inlaid Linoleum Making.

Consul John N. McCunn, in his annual report covering Dunfermline, furnishes the following description of the Scotch manufacture of linoleum:

Inlaid linoleum is making rapid strides in public favor. It is more expensive, as the colors are not merely printed on the surface of the fabric, but are solid all through. Under the original patent it was manufactured by means of stencils. The fabric which was placed on the canvas foundation was a mixture of oxidized linseed oil and ground cork, and to this mixture was added the desired color. By means of a stencil apparatus the black colors of a pattern were laid down on the canvas; thereafter the red parts were also laid down, and so on, and after the pattern had been completed the whole was subjected to hydraulic pressure and then dried.

This patent has expired, but a new process has been introduced in which each color is manufactured in sheets. A sheet is passed through a cylinder having knives which cut out the requisite parts of the color for making the pattern, and the machine deposits these parts on the canvas in the appropriate places. Each successive color is dealt with in this way, and after all the colors have been laid on the whole is subjected to heavy pressure. The benefit of this new patent, which has not expired, is that the division lines between the different colors are much more clearly cut at the joinings. The machinery for this new patent is very elaborate, the works being about 120 feet high, while the machine itself is nearly 110 feet high; the building and equipment cost about $340,655, and there are some fifteen flights of steel stairs built into the machine.

The Two Stellar Streams.

Systematic observation of the heavens has proved the existence of at least two great stellar streams, one of which includes our sun. Prof. Dyson has resumed the analytical study of stellar motions, observing 1,100 stars whose proper motions range from 20 to 80 seconds of arc per century. These 1,100 stars are distributed over both celestial hemispheres.

Dyson's observations confirm those of Kapteyn and Eddington and practically the same apices, or objective points, have been found for the currents by all three astronomers. The right ascension of the apex of the first stream of stars is between 85 and 94 degrees, and its declination is between 7 and 19 degrees, south. For the second stream the right ascension of the apex is between 240 and 292 degrees and the declination is between 48 and 74 degrees, south.

Kobold, at the observatory of Kiel, has been studying the subject from a different point of view. He has proved that the sun is moving through space in company with a great swarm of stars. It is the ignorance of this fact that has introduced the systematic errors in the earlier determinations of the apex of this swarm. Kobold's conclusions are in perfect accordance with those of the three astronomers quoted above, so that the existence of two great stellar streams appears more probable than ever.

Enameling Cement-Coated Walls.

The question of enameling cement-coated walls has frequently come up for discussion and various have been the suggestions as to the treatment likely to produce the best results. A correspondent of The Painters' Magazine asked in a recent issue as to the proper proportion and treatment of interior cement surfaces that are comparatively fresh and are to be enameled. He is called upon to finish in white some bathroom walls that are lined in imitation of tiles and are composed of Keene's cement. The walls have been finished for several weeks and appear to be fairly dry. In answer the authority in question says:

Keene's cement or marble cement, as it is sometimes called, is composed of plaster of Paris that has been steeped in a solution of alum and is then recalcined and reduced to powder. It is used the same as plaster of Paris, and while it will not stand outside, it is admirably adapted for interior work as a stucco. There is no extra caution required in preparing it for painting, as it is not caustic, like Portland cement, but requires sizing to stop suction.

For the walls of a bathroom, we should not suggest the use of glue, or glue or alum size, but for economy's sake would recommend the use of a good wall varnish, such as is offered by reputable varnish manufacturers. Two thin coats of this will stop all suction effectually. Over this two coats of a good inside flat white, the last coat of which should be smooth sandpapered, if required, in order to obliterate brush marks, then one coat of a good white enamel, which for a first-class job should be mossed down and finished with a flowing coat of the same white enamel, to which has been added some white enamel varnish or white damar varnish to enhance the gloss. Of course, every coat must be permitted to dry hard before applying another.

In cases where Portland or similar cement has been employed, two coats of white or bleached shellac varnish are preferable to the ordinary wall varnish, but in all cases the walls must be given time to dry before sizing.

Official Meteorological Summary, New York, N. Y., July, 1908.

Atmospheric pressure: Highest, 30.26; lowest, 29.70; mean, 30.5. Temperature: Highest, 93; date, 6th and 12th; lowest, 62; date, 16th; mean of warmest day, 84; date, 7th; coolest day, 70; date, 9th; mean of max. for the month, 84.3; mean of min., 69.4; absolute mean, 76.8; normal, 74.1; excess compared with mean of 38 years, +2.7. Warmest mean temperature of July, 78, in 1901. Coolest mean, 70, in 1884. Absolute max. and min. for this month for 38 years, 99 and 50. Average daily excess since January 1, +1.7. Precipitation: 4.33; greatest in 24 hours, 1.68; date, 14th; average of this month for 38 years, 4.38. Deficiency, 0.05. Accumulated excess since January 1, +2.47. Greatest July precipitation, 9.63, in 1889; least, 1.18, in 1907. Wind: Prevailing direction, south; total movement, 6,528 miles; average hourly velocity, 8.8 miles; max. velocity, 33 miles per hour. Weather: Clear days, 9; partly cloudy, 16; cloudy, 6; on which 0.01 inch or more of precipitation occurred, 8. Hail, 14th; dense fog, 31st. Thunderstorms, 2d, 3d, 4th, 12th, 14th, 22d, 23d, 24th, 25th.

According to a recent patent specification, a self-glazing fireproof clay is composed of a mixture of dried and powdered common clay, finely ground sand, and rock salt, in or about the proportions of 66 pounds of clay, 46 pounds of sand, and 9 ounces of powdered rock salt. Water is added to the mixture in order that it may be molded into crucibles or retorts or used as a lining for furnaces.

Correspondence.

To Prevent Spreading of the Rails.

To the Editor of the SCIENTIFIC AMERICAN:

I have been very much interested in reading your account of the possible and probable causes of the recent wreck on the New Haven Railroad, and it seems to me that knowing the cause, it should not be hard to apply a remedy, so as to make a recurrence of such an accident impossible.

I am not a practical railroad man, but it seems to me that if braces of steel were provided say every 15 feet, running from one rail to the other and securely attached to said rails, it would be almost impossible for one rail to shift without pulling its mate with it, and thus the gage would be maintained.

This would naturally be expensive, but if accidents could be reduced in number, the appliance would soon pay for itself. H. A. SWENSON.

Brooklyn, July 29, 1908.

The Widening of the Suez Canal.

To the Editor of the SCIENTIFIC AMERICAN:

We note in your issue of the 25th of July your article on the widening of the Suez Canal. Under one of the illustrations you state manual labor and primitive transportation are much used in the work, and this point we desire to discuss with you.

If you will notice the photograph, you will see that the transport is done by means of portable track and dump cars which have been supplied by our company for the work on the Suez Canal. This method of portable track is the most modern for excavating and transportation. This fact has been recognized in the different parts of the world and is used everywhere on the globe where excavation work is done. Only in the United States this method is not entirely known by all contractors, and a great number of them are using wheelbarrows and scrapers instead.

We can assure you, and we are prepared to prove, that in the United States to a large extent much more primitive methods for excavating and transportation are used than at the Suez Canal.

ARTHUR KOPPEL COMPANY.

Pittsburg, Pa., August 1, 1908.

The Railroad Spike is Obsolete.

To the Editor of the SCIENTIFIC AMERICAN:

Anent the article published in the July 25 issue of your publication, entitled "The Wreck of the White Mountain Express," I wish to submit a few original ideas and suggestions for publication.

With the beginning of railroad construction in this country, a very crude, cheap, and quick method was adopted and used by all the different roads to connect and fasten the rails to the wooden ties.

This was a rough-cut, wrought-iron spike about 5/8 inch square by 5½ inches long, and with the most of the head formed on one side to overlap and hold the rail in position. This spike answered the purpose in the experimental stages of railroad construction, when the rolling stock was light and speed limited, the locomotives weighing from six to twenty tons, and the cars and other equipment in proportion; but now it seems as if the old-style spike has outlived its usefulness, and is being taxed beyond its capacity. Little or no improvement has been made in spikes to fit the changed conditions. The constant increase in weight, size, and speed in all equipment, locomotives, and other rolling stock has put the strain beyond the limit of safety, and what was formerly considered a good, safe, and cheap method of fastening for the rails, I now consider a very weak, insecure, and expensive method, if you take into account the many and serious wrecks that are caused directly by the spreading of the rails.

The principal reason why there are few wrecks in England and other foreign countries is because these countries have adopted better methods of rail fastening. Over fifty per cent of all wrecks are directly caused by this serious weakness in construction. Here are my views on the subject from the railroad point of view, both as to economy and safety.

By adopting some good, safe method that will hold the rails tight, it will not only eliminate the danger of the rails spreading, and all wrecks caused by that serious defect, but it would also add from one-quarter to one-third to the life of the wooden tie, as the cut spikes so soon pull or work loose, and let the water into the timber, hastening decay as well as letting the loose rail move and vibrate, thereby causing the tie to wear away under the rail. Some of the roads have been experimenting with the screw spikes that are used in England and France, with a view to using them extensively on their roads. There is one other point worth mentioning, and that is the kinds of tie plates some of the roads are now using. They evidently go upon the theory that the rougher they are made on the nether side, the better for the purpose. They try to make the plate help to hold the rails, making the under side rough and uneven, so as to sink into the top surface of the tie, but they let the rails work loose, and then the constant vibration of the rails causes these roughened projections on the bottom to cut into and wear down the wood, thereby helping to destroy the ties.

I saw the result of such wear on a bridge equipped with some of this kind of plates on new sawed oak ties. After these were in use three years they had to be replaced by new ones, owing to deep wear these plates had occasioned. A better idea would be to make the plates perfectly smooth on the bottom, to protect the tie under the rail, and have the rail fastening sufficient to hold both the plate and the rail.

The United States Forest Service circular, Department of Agriculture, No. 146, gives some very interesting data in regard to experiments with screw spikes. It gives the holding power of screw spikes at from *two to four times* that of the old cut spike, consequently eliminating the wear and absorption of moisture in the body of the tie.

The first cost will of course be higher to install this system of securing the rails, but the increased life of the tie, the lower cost of repairing the track, and most important of all, the fewer wrecks caused by spreading rails, would very soon make up for extra cost in installing. DR. W. C. LANGMAN.

Cincinnati, Ohio, August 3, 1908.

Military Possibilities of Aeroplanes.

To the Editor of the SCIENTIFIC AMERICAN:

Your recent editorial upon the difficulties of waging modern war after the aeroplane has been perfected was excellent, and your arguments are practically indisputable. But while I entirely sympathize with your desire not to entertain revolutionary opinions, I think that a person might go much farther in the same direction and still be eminently conservative.

I do not at all agree with your editorial published some months ago upon the impracticability of attack by the use of high explosives dropped from flying machines. It seems to me that with the height and speed of the aeroplane and the direction and velocity of the wind known, all of which could readily be ascertained with fair accuracy, striking the target would be a simple calculation under the laws governing falling bodies. A telescopic sight would of course be used, and if the first shot missed, a slight adjustment would insure greater precision.

Suppose that every nation was provided with a fleet of airships, each capable of traveling sixty miles an hour and carrying five hundred pounds of high explosives, and you have a condition where war would be almost unthinkable.

If France and Germany, for instance, were to declare war, each would at once start its aeroplanes; and even if by mutual consent the cities were not harmed, every railroad bridge in either country would probably be speedily destroyed. It might be possible to construct cannon to fire vertically, but when you consider the height and speed of the flying machine and its small size, as well as its ability to see where its shell struck, the advantage of the uppermost combatant must be overwhelmingly apparent, and a bridge could hardly be protected. And without railroad transportation mobilization and subsistence of a modern army would be an exceedingly difficult problem.

But supposing this accomplished and the troops brought together into camps, what more vulnerable situation can be imagined? Each camp would at once become a target for thousands of pounds of high explosives coming at night out of the darkness, and without a possibility of an attempt at retaliation. Even if the casualties were not excessive, I very much doubt if any army would stand more than one night of such an attack without dispersing.

The fact that each nation could attack the army of the other in the same manner, with small chance of protecting its own, would be an additional deterrent to a declaration of war.

Then again there are the cities. Two nations like France and Germany might agree to spare each others' cities and keep the obligation, because each would have so much to lose. But if, as generally happens, a large nation had a controversy with a small one, the larger nation might fight at a great disadvantage, because it would have the most to be destroyed.

If the British government had known that the Boers had a fleet of airships laden with five million pounds of nitro-glycerine in Holland, ready to attack London as soon as war was declared, there would have been no war. Nations make war generally because their rulers expect to gain something thereby. But all the mining speculators in South Africa could not have repaid the English for the city of London.

There are many other social problems which stand a fair chance of being solved by aerial navigation. I do not see how the autocracy of Russia can survive. A nihilist at night on a flying machine might make it extremely unpleasant for the occupant of the Winter Palace.

I believe that our protective tariff is in similar danger. Custom houses exist because all commerce passes through narrow channels where tolls can be collected. But with the opening of the boundless air smuggling will speedily begin around all our borders. It would, of course, not pay to carry heavy materials in this way; but with the finer manufactured goods the profits should be very large and the risk of detection slight. And if smuggling in the more expensive commodities were extensively carried on, how long would the makers of similar articles in this country stand a tariff on raw materials?

All things considered, I do not think it at all wild to predict that we are upon the verge of as great an improvement in the condition of the human race as occurred when our ancestors first learned to navigate the water many thousand years ago.

PHILIP CRUTCHER.

Vicksburg, Miss., July 29, 1908.

To Change Existing Battleships to "Dreadnoughts."

To the Editor of the SCIENTIFIC AMERICAN:

Amid all the talk concerning the increase of our navy and its relation to Japan's now and what that relation will be in the near future, one point seems to me to have been overlooked. That is, of modernizing our battleships of 12,000 tons displacement and over, so that they may be able to take their place in line with the "Dreadnought" type. They cannot do so in their present condition.

In spite of all reports to the contrary, the United States will undoubtedly keep pace with Japan in the matter of building "Dreadnoughts." But Japan has gone a step further. All her battleships that were in the war with Russia, including those captured from Russia, have been and are being modernized. The "Mikasa," raised from the mud of Sasebo Harbor, in the course of her refitting, will have a part of her superstructure cut away and her secondary battery of sixteen 6-inch substituted by eight 6-inch and four 10-inch (the latter placed two in a turret in two turrets, one on each beam as in our "Georgia"). The same will be done with the "Asahi," "Shikishima," "Fuji," "Hizen," "Suwo" and "Sagami," the last three named being the former Russian "Retvizan," "Pobeida," and "Peresviet." In a recent article in the SCIENTIFIC AMERICAN your correspondent told what the Japanese did with the "Orel," now the "Owami." This improvement I speak of is on a greater scale than that, but has been confirmed by a Tokio official dispatch and when accomplished will make semi-"Dreadnoughts" out of vessels that would have been unable to stand in the first line of battle had it not been done. The 10-inch gun is now very powerful. This change in the Japanese ships will give Japan eight of these semi-"Dreadnoughts" and two new ones, the "Kashima" and "Katori." Add to this her six "Dreadnoughts," two second-class battleships, and thirteen armored cruisers and she has quite a formidable array. Now the question is, Can this be done with our vessels? It can be, and surely ought to be done. Admiral Evans has recommended the removal of our cumbersome flying bridges, military masts, and cranes, and the substitution of skeleton masts and booms. This lightening of weight would just about balance the increase in armament. In the "Connecticut" type eight 10-inch instead of eight 8-inch guns should occupy the four beam turrets, even if the turrets have to be changed, and the same should be done with the two beam turrets of the ships of the "Georgia" class, substituting four 10-inch for four 8-inch, but leaving the four superposed 8-inch as they are. The "Idaho" and "Mississippi" I would change in the same way as the "Connecticut" class, as they are already slow ships, and this increase of weight on their smaller displacement would not matter. In the "Maine" class, four 10-inch guns should take the place of ten of the sixteen 6-inch of her secondary battery as in the "Mikasa." The value of the 10-inch gun, its power, and its superiority over the 8-inch is unquestionable. If Japan can accomplish this change, we can. With this modernizing completed the United States would have 16 semi-"Dreadnoughts" against Japan's 10, 6 real "Dreadnoughts" against Japan's 6, 9 second-class battleships against Japan's 2, and 15 armored cruisers against Japan's 13. This would make a total of 22 first-line ships of the United States against Japan's 16, and 24 second-line ships against Japan's 15, an overwhelming majority. But as the countries stand now each has six first-line ships and are therefore equal, as it is the first-line ships that count. This equality is true in spite of the fact that we have, excluding the six "Dreadnoughts," *thirteen* more battleships than Japan. Only "Dreadnoughts" or semi-"Dreadnoughts" can take the brunt of battle in which "Dreadnoughts" are on both sides, and even our splendid "New Hampshire," now at Quebec, can not be considered in the same battle class with the British "Indomitable," alongside of which she is anchored.

HAROLD M. KENNARD.

Brooklyn, N. Y., July 23, 1908.

THE MECHANICAL JOYS OF CONEY ISLAND.

Coney Island, that marvelous city of lath and burlap, should always be approached by sea, as then, and then only, can the beauty of this ephemeral Venice be appreciated. Landward, the trains run through squalid neighborhoods, and past the back of everything. Its best foot is put forward toward the sea.

It is a question if Coney Island proper is not more crowded than any city in the world (except possibly Cairo) during the heated season. Hundreds of thousands of visitors come to the island not only to be cooled, bathed, and fed, but also to be amused, and this demand for entertainment has resulted in one of the most colossal aggregations of rides, slides, drives, whirls, and "thrillers" that the world has ever seen, and there are over 450 moving picture shows. We doubt if any accurate figures are obtainable as to the horse-power required to operate the various amusement devices, or of the amount of current consumed for electric lighting. It is stated on very good authority that a rainy Sunday means a loss of over half a million dollars in the section known as Coney Island proper. If a careful census were made of all the owners and lessees, we would not be surprised if this amount were nearly doubled.

For some years it has been the custom of a member of the editorial staff of the Scientific American to visit the interesting pleasure parks from time to time, and illustrate some of the mechanical illusions and "thrillers." This year there are so many new devices and improvements on the old ones, that we have decided to give considerable space to their consideration. After the old, time-honored carrousel, which still remains so popular, and which is so very much in evidence at Coney Island, we come to the various

The "Mountain Torrent." An Aqueous Ride.

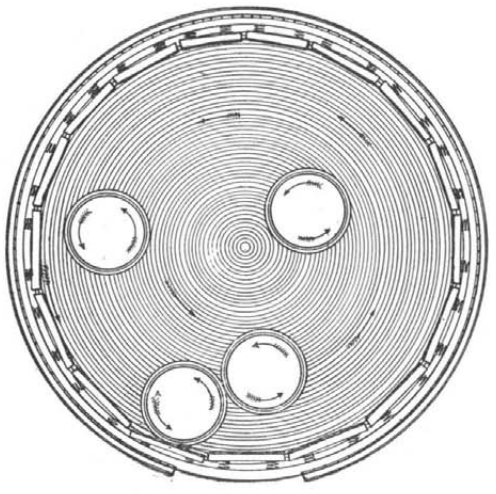
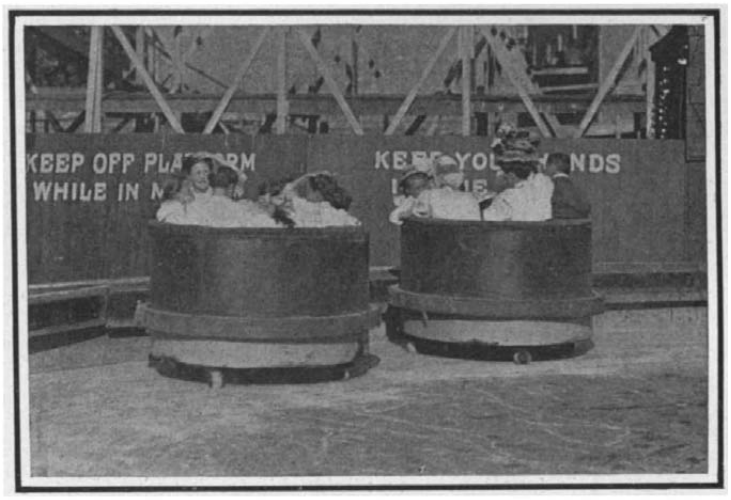
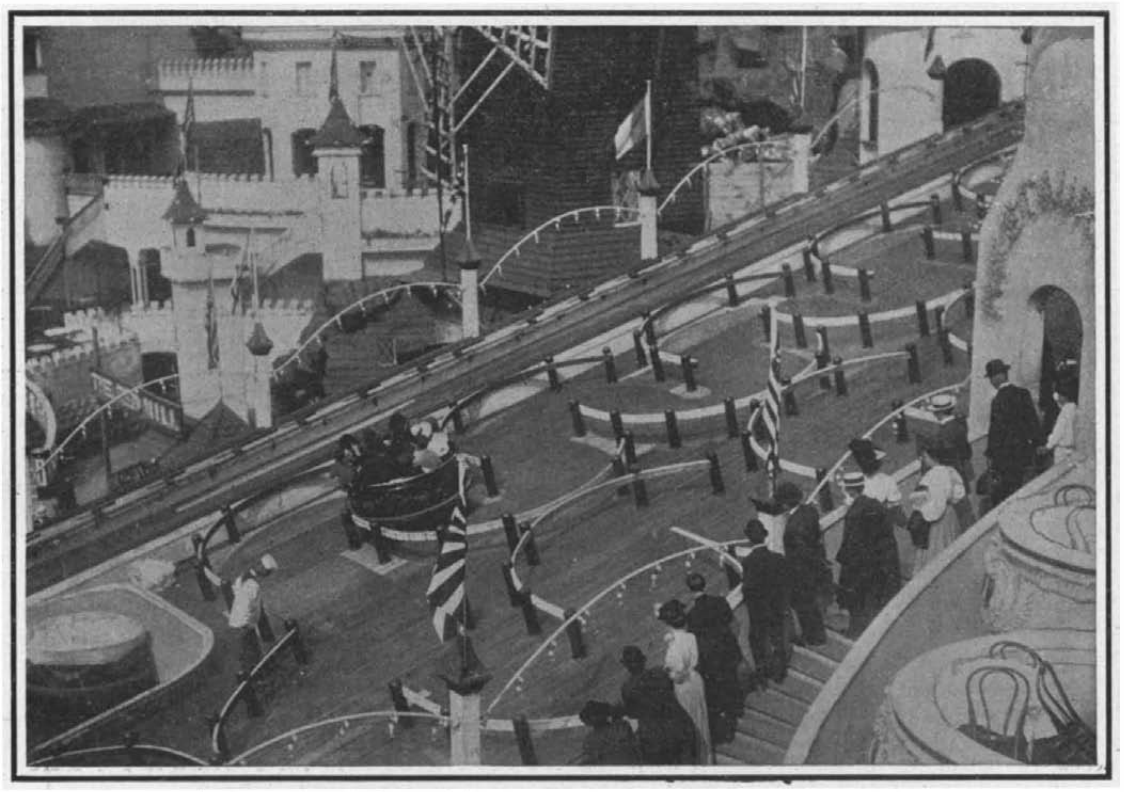


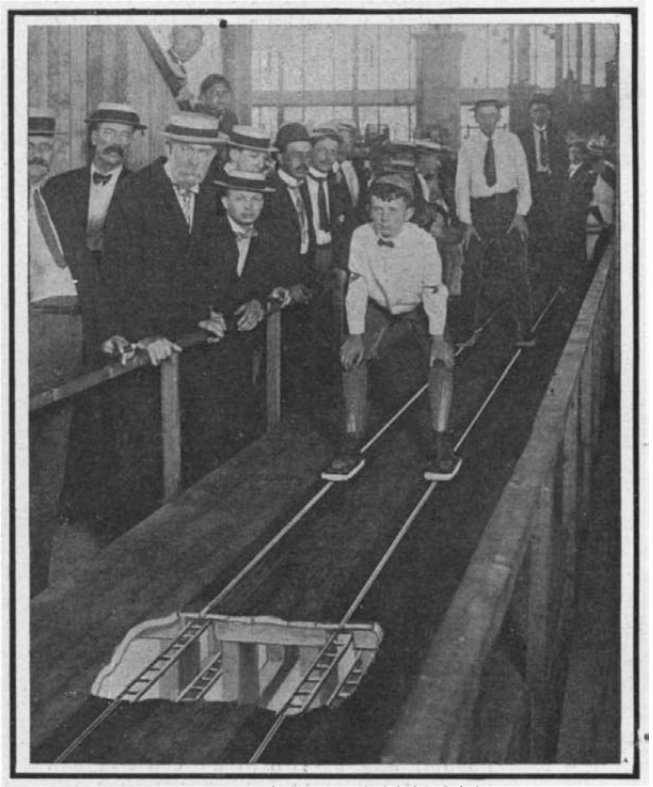
Diagram of the "Scrambler," Showing Direction of Rotation.



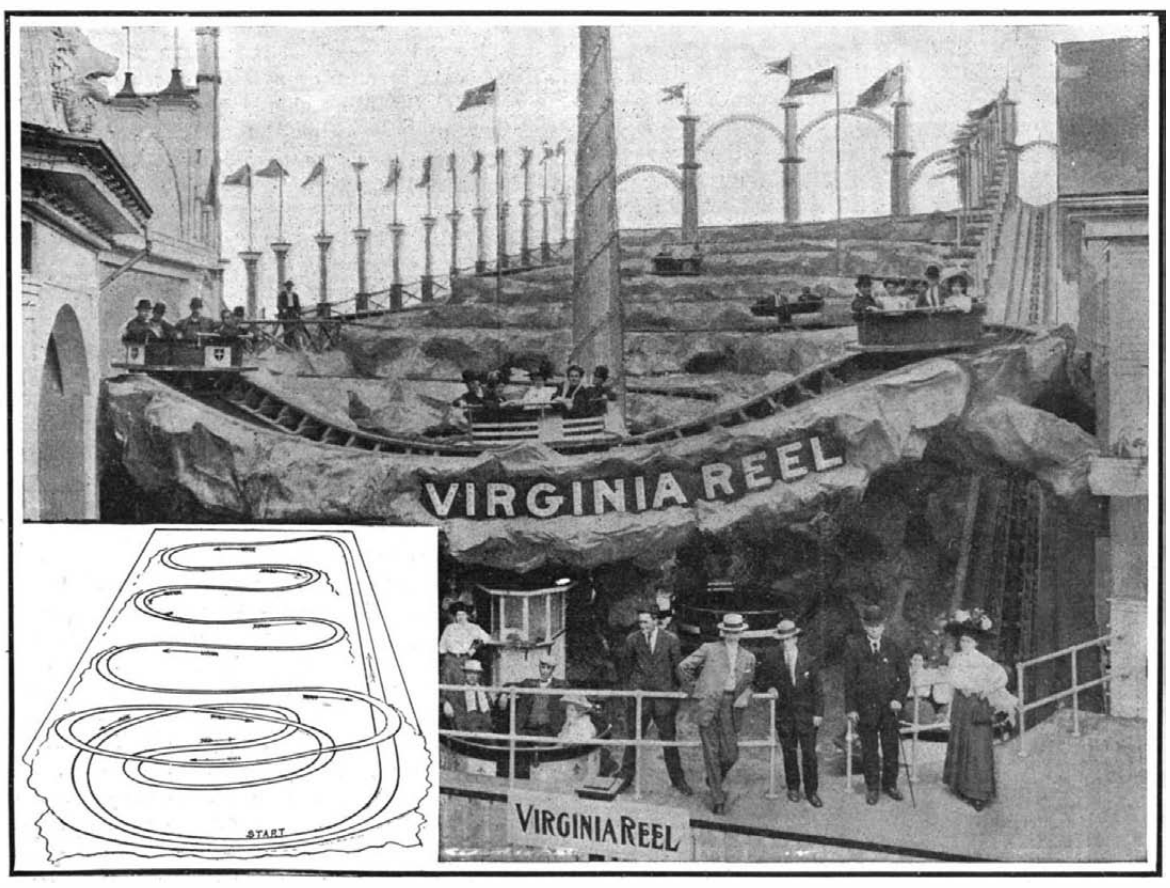
The "Scrambler." A Circular Rotating Floor Causes the Cars to Spin and Carom.



The "Tickler." An Inclined Plane Down Which Circular Cars Mounted on Casters Carom.



The "Arkansaw Traveler." Each Track Moves Independently, to the Sorrow of Many Would-be Travelers.



A Sinuous Pleasure Way in Which the Circular Car is Pivotally Mounted on a Wheel Truck.

A Third-Rail Mountain Coaster Taking a Dip.

so-called "rides." The first devices of this kind were built in the open air, and did not contemplate the passage through caves or among painted scenery, and you were apt to have to walk up the inclines; then came the switchback, and finally cars propelled up the grades by motors, as shown in one engraving. Now we have our choice of all varieties of this type of amusement device. We illustrate several, built upon varying principles.

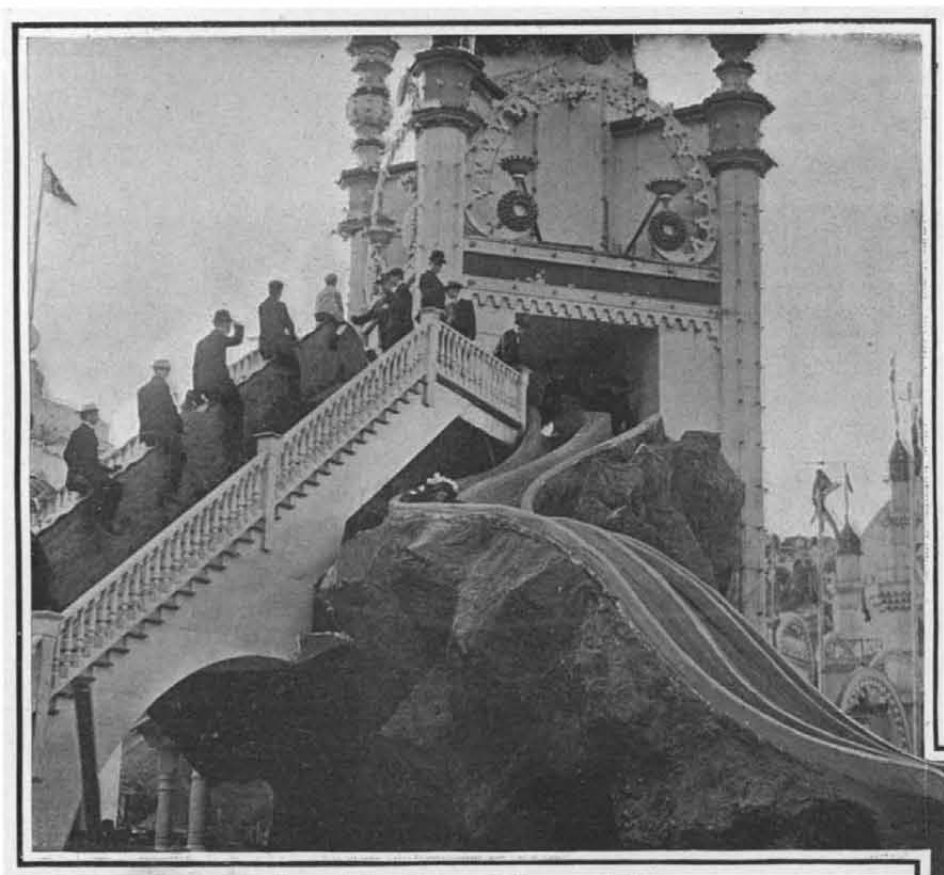
Safety in the operation of the carriages at high speed is of paramount importance. The invention of Stephen E. Jackman, of New York, robbed them of their terrors. With the aid of Mr. Jackman's brake mechanism for inclined railways, these carriages are actually held stationary in mid-air. The brake is set by an attendant a couple of hundred feet away. It is extremely dangerous to allow passengers to manipulate, or even attempt to brake, these cars. Formerly, a brakeman was carried on each coach to control the car, but with this improved brake mechanism, a car can be controlled on the down track or home stretch independent of the occupants. Our photograph, which has been cut away to show the mechanism, displays a number of brake beams, arranged longitudinally with the track, one in front of the other, and adapted to engage a brake surface on the car traveling on the track. When it is desired to stop the car for any purpose, the lever is pulled, which in turn raises the beams from the horizontal plane of the track, and practically lifts the wheels from the track. With the aid of wires the brakes can be set on any part of the amusement way. An emergency brake when used releases a detent, which allows a heavy weight to fall, and with the aid of wires automatically sets all of the brakes on all the tracks. This device of Mr. Jackman has been extensively used in various parts of the island. Serious accidents have occurred by passengers unloosening the bar which holds the occupants of the car in safety. The same inventor has devised a special lock which is applied by an attendant after the passengers have been seated. To avoid tampering with the lock, which passengers often did, he has provided an automatic lock to "lock the lock," which is applied by a tripper when the car first starts up the incline.

The "Mountain Torrent," invented by Frederic W. Thompson, the founder of Luna Park, is one of the most interesting rides in Coney Island, and it is certainly a "thriller." A steep escalator in two sections serves to raise the prospective rider to a considerable elevation. As soon as a boat at the top is comfortably filled, it is started down an inclined track, a portion of which is under water. The track follows a sinuous path, which constantly changes its level. A portion of the track runs through a tunnel, and part of it runs through a pond or lake. Waterfalls and hills and mountains add to the picturesqueness of the scene. Our engraving represents the boat just as it is passing through the lake. The ride is a most exciting one, and never fails to furnish material for wild screams. The boats are hauled to the top by means of an endless cable.

The "Tickler" is a novel riding device, consisting of an inclined plane having a hard wooden floor, on which is laid out a sinuous course, or run, on the outside of which are guide rails supported by posts, and adapted to change the course of the car in its descent down the incline. On one side of the structure is a chain elevator, by which the loaded cars are hauled to the top of the incline from the loading platform at the bottom or starting point. On the top the car is released, and starts its antics, whirling, skidding, and rolling through the course, and affords the greatest pleasure to both riders and onlookers. This is one of the severest "bumps" on the island. The cars are circular in form, are built of steel, and are large enough to accommodate eight passengers comfortably. The car is provided with an annular resilient bumping ring, which bears against the guides as the car descends the incline. At the bottom of the car are various ball-bearing casters, which give the cars the comical and erratic run. The "Tickler" is the invention of Mr. W. T. Mangles, of New York, and the latest type has been modified with the assistance of Mr. C. M. Brewster.

Another very interesting ride is the "Virginia Reel," invented by Mr. Henry Elmer Riehl, superintendent of Luna Park. The car is also circular in shape, and is pivoted to a wheeled truck. The car body is free to revolve on a kingpin, and can be rotated by projections on the body of the car which engage with the springs supported alongside the track, and this tendency is noted when the car begins to travel down the sinuous and intricate winding pathway. The turning motion renders the ride exceedingly exciting and interesting to the occupants of the car. Comparatively little space is required for an amusement device of this nature, as owing to the manner in which it is laid out, great economy of space is effected. Our engraving shows the cars at various parts of the ride, but the main spiral is in the tunnel or grotto, which renders the ride still more attractive to the occupants of the car.

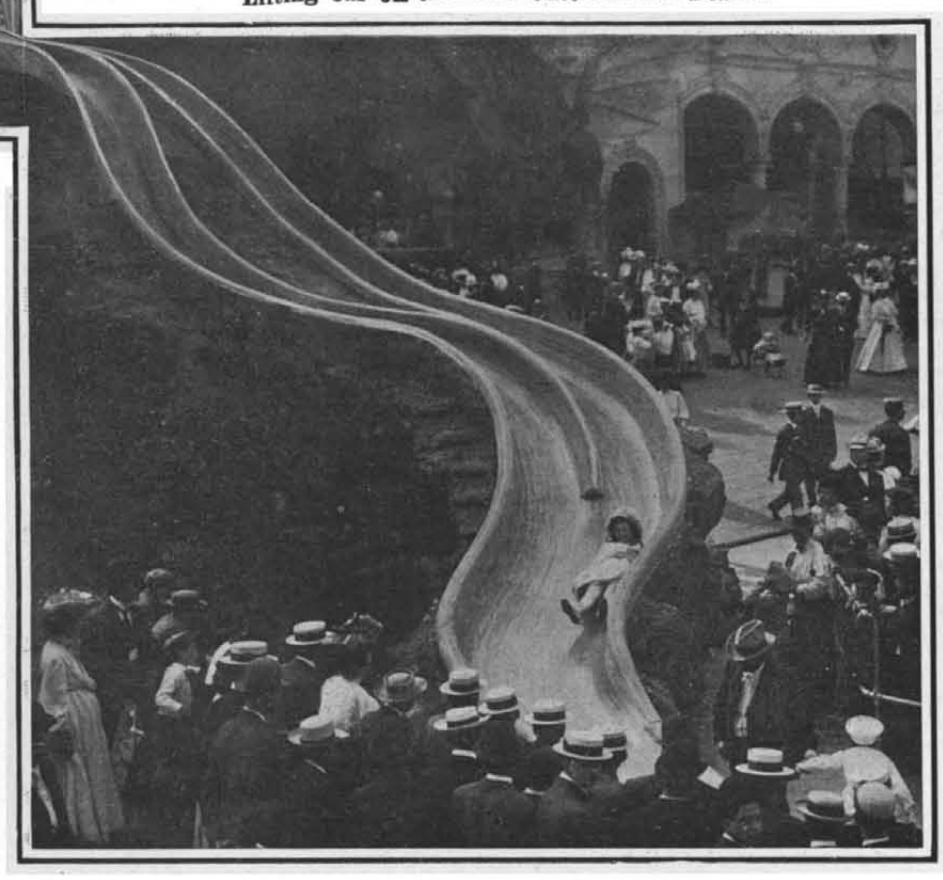
One of the most unusual attractions on the entire island is the "Witching Waves," which has recently been installed in Luna Park. It is the invention of Mr. Theophilus Van Kannel, of New York, who is also the inventor of the revolving door. Our large front-page engraving shows the general arrangement of the visible portion of this amusement way. The waves are of such size, proportion and speed as to exactly simulate the waves of the sea. There are two moving runways between the "island" and the mainland, down one of which may be seen the de



The Top of the Human Toboggan Slide.

Lifting Car Off the Rails Onto Friction Beams.

"Hitting the Pipe." Exit at the Bowl.



The Bottom of the Human Toboggan Slide. Made of Rattan.

THE MECHANICAL JOYS OF CONEY ISLAND.

lighted visitors, seated in boats or little cars. The two longitudinal runways are parallel, as are also the transverse, stationary runways, from one of which the passengers embark, while they coast down the other to the second longitudinal runway. The motion exactly simulates that of the waves of the sea, and all enjoy it, good and bad sailors alike. The wave motion is imparted to the flexible steel sheet flooring by the mechanism which we illustrate on our front page. In passing, it should be stated that the forward travel of the conveyance is caused by the constant rise of the strip or sheet in the rear of the same. In other words, the passenger is always on a down grade.

At one end of each longitudinal runway is a motor which serves to drive the mechanism which produces the progressive rising and falling movement of the wave sheet. Geared cranks serve to actuate long pitmans, which serve to pull the great connecting rods to and fro in a horizontal plane. The horizontal motion is changed into a rising and falling motion by bell cranks, which actuate lifting bars which move in a vertical plane. These lifting bars actuate two levers, which are beams secured at the outer end by pins. It is the progressive movement of these beams which gives the flexible sheets their progressive rising and falling motion. There are 16 bell-cranks to every wave, which is 16 feet long. While one pair of beam levers is being raised, the next follows and so on until the full cycle of motion is accomplished. The mechanism is so well equalized, that only enough power is used to overcome inertia and friction.

This is an illusion which has to be seen to be appreciated, and it is a clever adaptation of some of the fundamental principles of mechanics to produce an apparently complex result.

The "Scrambler" is an amusement device based on centrifugal force. In an inclosure a circular floor section is mounted to revolve. The upper surface of the platform is slightly dished from the center to a point near its periphery. The circular table or floor is rotated by a motor at a rapid rate of speed. The cars are of elliptical or oval conformation. There is a bumper made of resilient material placed around the circumference of each car. In the operation of this amusement device, the cars are placed in the central portion of the platform, which is then revolved as rapidly as may be desired. The cars, by reason of centrifugal force, will be propelled in the direction of the periphery of the platform, and at the same time will be given a rotary motion. A rocking motion is also obtained by the use of caster wheels. The cars strike several buffers and rebound. The circular side wall is interrupted, and is composed of a large number of spring buffers, which give when struck by the car. The "Scrambler" is the invention of Mr. H. A. Bradwell, of New York, N. Y.

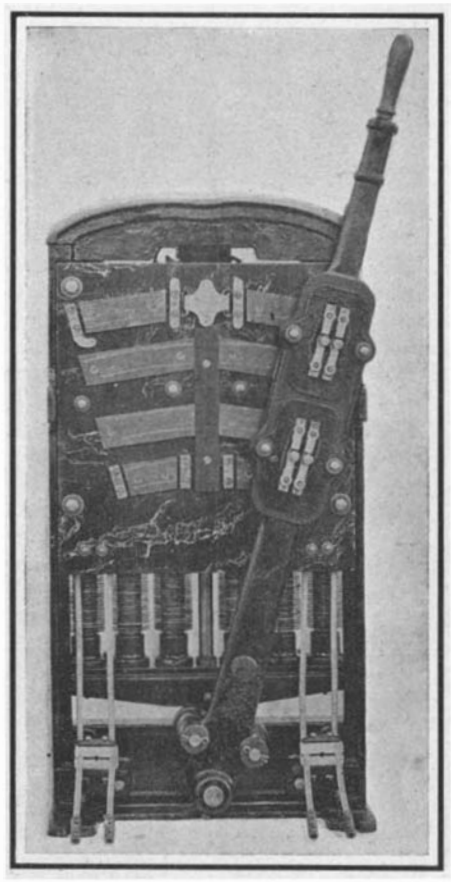
The "Human Toboggan Slide" never fails to draw immense crowds. In the one which we illustrate, which is in Luna Park, an escalator serves to take the would-be sliders to the top of a rattan slideway, which follows a sinuous course. Once on the rattan there is little standing or rather sitting on the order of going, and after an instant whirl, one is precipitated on to a mattress, to the huge delight of the watching crowd. This is the invention of Mr. Frederic W. Thompson, founder of Luna Park.

Steeplechase Park also has a number of very curious amusements, in one of which the principle of the "Human Toboggan Slide" is utilized. This is called "Hitting the Pipe." The pipe consists of an immense affair shaped like a tobacco pipe. Entrance is obtained through the mouthpiece, and exit is summarily thrust upon the would-be slider at the top of the bowl. Great care is taken to make these various slides safe, as otherwise a loose piece of rattan would be likely to do serious injury. One of the curious amusement devices in Steeplechase Park is called the "Arkansaw Traveler." It consists of a track having two openings like the underground trolley slots. A plow comes up at various intervals, and foot pieces are attached thereto. On being admitted to the "Traveler," a foot is placed on a foot piece of the two tracks. Mechanism is provided for varying the speed of the travel of the foot pieces, and the result is that the passengers are contorted into curious attitudes. The device, while simple, has been well carried out.

An interesting phenomenon that may be of use in the ignition of explosives is creating some interest in Germany. According to a consular report, it has been discovered that an alloy of iron and cerium, lanthanium, or any other of the rare substances which are used in the manufacture of incandescent gas mantles will create luminous sparks on being struck with a metal tool, such as a knife edge, file, or the like. The sparks given off at the point of impact are sufficient to ignite not only gas, but even a cotton wick saturated with alcohol, and it is possible that these alloys may be utilized for igniting all kinds of explosives. The behavior of these alloys has been found to vary according to their percentage of iron, the sparking reaching a maximum when the iron content is 30 per cent.

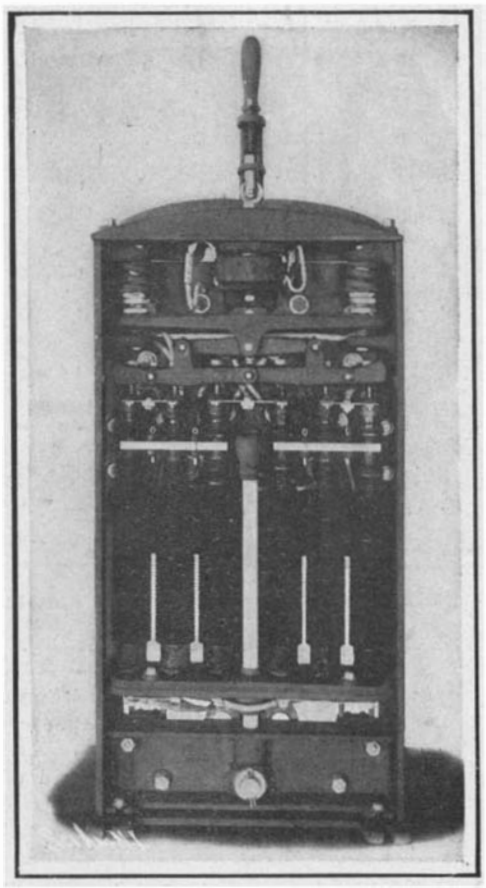
A NO-SEGMENT GRAPHITE-RESISTANCE CONTROLLER.

The principle of the carbon microphone has been utilized to produce a controller in which there are no abrupt steps from one degree of resistance to another. In the usual telephone transmitter the diaphragm bears against a small quantity of granulated carbon, through which the line current passes. As the diaphragm is vibrated by the voice, it varies the pressure at the contact points of the hundreds of carbon granules, thus correspondingly varying the resistance of the circuit. In the same way the no-segment controller varies the resistance of the circuit by pressure at a series of contact points. In place of carbon granules, columns of graphite disks are used, and a powerful lever mechanism is employed to compress the columns.



Front of the Controller, Showing the Compressing Lever.

The disks are about an inch in diameter and ⅛ of an inch thick, and the imperfect contacts between them when under no pressure but their own weight, offer a high degree of resistance to a current following through the column. Such a column offering 110 ohms will have its resistance lowered to but 1 ohm when the extreme limit of compression afforded by the lever mechanism has been applied.



Rear of the Controller, Showing the Resistance Columns.

A NO-SEGMENT GRAPHITE-RESISTANCE CONTROLLER.

The controllers are usually built with several resistance columns, each comprising an insulated tube in which the disks are piled, one above the other. These tubes are provided with radiator fins or rings, to dissipate the heat that is generated in the resistance columns. The tubes are carried on a yoke or cross-head at the bottom of the controller. The lower side of the cross-head is formed with inclined cam faces adapted to engage one or the other of a pair of rollers mounted on the operating lever. When the lever is moved out of its normal, vertical position, one of the rollers engages and lifts the crosshead, thus jamming the columns of disks upward against the top of the controller. Here a series of levers are arranged to equalize the pressure, and provide a uniform compression of each column of disks. The degree of compression is governed by the extent to which the lever is moved from the vertical. When the lever is in vertical position, the circuit is broken; but when moved out of this position, a set of brushes on the lever engages a series of contact plates, and closes the circuit through the controller. The resistance columns are subjected to the maximum degree of pressure, permitting practically a full flow of current, before the lever is moved to the extreme position, and the last move of the lever cuts out the graphite columns entirely, and allows of an unobstructed flow of current. To reverse the current, the lever is moved in the opposite direction, bringing the brushes into contact with another set of contact plates.

These no-segment controllers are built especially for use with crane motors. There is probably no other condition in which the controller is subjected to a more severe strain than in connection with an electric crane. The current must constantly be thrown on and off. No time can be spared for a gradual variation of resistance. The crane motor must be started, stopped, or reversed on the instant, regardless of the destructive effects produced. In the ordinary controllers with fixed resistance units of wire, ribbon, etc., the units are cut out of or into the circuit successively, or step by step, and there is a considerable flashing and sparking at the contact points. The contact plates and brushes are constantly in need of repairs, and the resistance units frequently burn out. In contrast with these conditions the no-segment controller admits the current steadily instead of by jerks, and there is no arcing or injurious flashing. The slightest motion of the lever means a different speed of the motor. No injury is done by keeping the current on the resistance. Any desired horse-power is secured by multiplying the number of resistance columns.

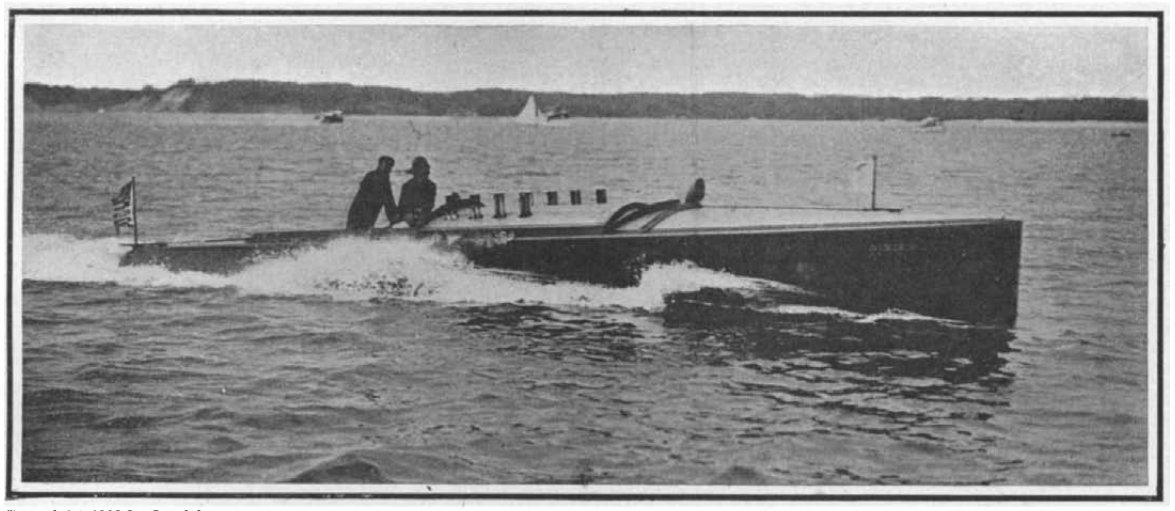
Originally, carbon disks were used in this controller, but they were not able to withstand the heat generated in the controller, and in service they disintegrated, and clogged the tubes with carbon powder. The use of graphite instead of carbon was suggested by a traveling salesman, Mr. Henry T. Jones, who had heard of the heat-resisting qualities of this material. The chief objection to graphite was its superior conductivity, and in the first experiment only a few of the graphite disks were placed in the upper part of the carbon disk columns, in order to obtain the desired control. Eight months of constant and severe service failed to produce any injurious effects on the graphite disks, while it was necessary frequently to remove the carbon disks. Mr. Jones then learned that the graphite used for railway signaling purposes, after being subjected to a heat of 7,500 deg. Fah., is an excellent conductor; but the constant arcing and alternate heating and cooling in service has the effect of hardening the material and impairing its conductivity. Accordingly, he subjected the graphite disks to a similar treatment. The disks, after having been exposed to a heat of 7,500 deg. in the electric furnace, were repeatedly heated to a temperature of 1,200 deg. Fah., while exposed to the air, until the desired degree of hardness and resistance was obtained. The graphite disks thus treated have entirely supplanted the use of carbon. In service it is impossible to produce a temperature high enough to further affect the resistance of the graphite.

The heat-resisting qualities of graphite are astonishing. In a recent experiment some of the treated graphite disks were repeatedly subjected to a current of 75 amperes at 1,900 volts. This powerful current was applied at least thirty times to one of the disks, but it failed to affect the graphite in the least. A set of resistance tubes was also subjected to a severe test. The current was allowed to run continuously for ten hours through the resistance. For six hours of that period the steel tubes were red hot, and they were partly melted by the heat generated, but the graphite disks in the tubes remained uninjured, and are still in use in a 50-horse-power controller.

The second largest masonry arch in the world has, according to Engineering News, recently been built on a new railway in Austria. This arch is the largest span of a bridge over the Isonzo River, and is 278.9 feet, having a rise of 78 feet. The arch is of cut stone founded on reinforced concrete footings, backing into solid rock. It is 6.6 feet thick at the crown. The largest masonry arch in the world is at Plauen, Germany, having a span of 295 feet, and the hitherto second largest, at Luxembourg, with 277.6 feet span.

THE INTERNATIONAL MOTOR BOAT RACE FOR THE HARMSWORTH TROPHY.

After a postponement of two days owing to rough weather, the International Motor Boat Race for the Harmsworth trophy was held in Huntington Bay on Long Island Sound, August 3. There were but two English boats sent to America to challenge for the trophy, which was brought here last year by the "Dixie" of Mr. E. J. Schroeder, while America was represented by a trio consisting of the "Dixie II," the "U. S. A.," and the "Den." These three boats had been selected out of eight or more that were entered, as they were the only boats to put in an appearance or to demonstrate their ability to race in the preliminary trials, only one of which was held.



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"Dixie II," the American Winner of the International Motor Boat Race for the Harmsworth Trophy. The "Dixie" Covered the 10-Mile Triangular Course Three Times in 1 Hour, 4 Minutes, and 57 Seconds at an Average Speed of 27.71 Knots.

The race was started at 3 P. M. under splendid weather conditions. The Sound was smooth, and the boats were able to make very fast time. The course was a triangular one, 10 nautical miles in length, the apex of the triangle being in the harbor, and the base of it in Long Island Sound. The "Dixie" was first to cross the line, which it did 14 seconds after the starting whistle blew. The "Den" crossed the line second, and was quickly followed by the "Daimler II" and the "Wolseley-Siddeley." The "U. S. A." was late in starting, on account of a slight accident, but after it did get away, it soon passed the "Den," which dropped to the last place.

While traversing the base of the triangle in the first round of 10 nautical miles, the "Daimler II" had trouble with one of her engines, and was passed by the "Wolseley-Siddeley." The former boat abandoned the race at this time, and throughout the balance of it the other English boat tried, in vain, to catch the "Dixie II." On the second round she gained 21 seconds on the "Dixie II," but in the first part of the third and final round the "Dixie" regained her lead, and finally finished 49 seconds ahead of the fast British racer of double her power. The elapsed times of these two boats were 1 hour, 4 minutes, and 57 seconds (corresponding to an average speed of 27.71 knots, or 31.94 statute miles an hour) and 1 hour, 5 minutes, and 46 seconds (corresponding to 27.34 knots, or 31.51 statute miles per hour). The "U. S. A." and the "Den" finished in 1:15:11 and 1:20:47, or at average speeds of 23.9 knots (27.55 miles per hour) and 22.3 knots (25.70 miles an hour).

As the result of this extraordinary performance of the "Dixie," the beautiful trophy will remain in this country another year. The hull of the defender was designed by Clinton H. Crane and built by Frank Woods. It is of light construction, 39½ feet long by 5¼ feet beam, and is fitted with an 8-cylinder, V-type gasoline engine of slightly over 200 horse-power. The engine was built by Messrs. Crane and Whitman. Its cylinders are 7¼ x 7¼ inches, and at the average of 825 R.P.M., which is about what it made in the race, this engine is capable of developing about 225 horse-power. The valves are located in the heads of the cylinders, each pair being operated by a single rocker arm worked from one camshaft. The complete power plant, consisting of engine, clutch, and reversing gear, weighs between 2,100 and 2,200 pounds, while the displacement of the boat with supplies and crew was about 4,700 pounds. A metal-to-metal cone clutch is used in combination with a positive jaw clutch. The engine is thoroughly lubricated by oil pumped through the hollow crankshaft. The propeller used is a three-bladed one, 26½ inches in diameter and 49-inch pitch.

The "Wolseley-Siddeley" and her engines were illustrated in our issue of June 13. The second English boat had triple screws driven by three 8-cylinder, V-type engines of about 175 horse-power each. This boat showed excellent speed, and would have stood a good chance of winning if one of the engines had not given out. The "U. S. A." was fitted with two 4-cylinder Chadwick engines of 100 horse-power each. This boat ran very smoothly, but did not have sufficient power to drive her at the speed of the leaders. The "Den" was the smallest boat in the race. She is equipped with a 4-cylinder engine of 80 horse-power. The hull of this boat was designed by Charles Herreshoff. When traveling at full speed, the first half of the boat was entirely out of water.

The photographs which we reproduce show the excellent running qualities of the "Dixie's" hull, which throws much less spray than that of the "Wolseley-Siddeley." It was due to her excellent lines that the "Dixie II," in a private speed test held last week, was able to average 35.85 statute miles an hour over a 1.1 nautical mile course. This is the fastest speed over an accurately measured course that has ever been made by any motor boat.

Carbon Extracted by Plants from the Soil.

The researches of numerous investigators have proved that plants do not derive all their carbon from atmospheric carbonic acid, as was formerly believed. The most recent experiments are those of Lefevre, which have just been published. Lefevre used a soil composed of sifted sea sand, washed with acid, calcined and mixed with sterilized chopped moss. To this were added certain mineral salts (according to Detmer's formula) and also certain organic amides in the following proportions: 1 part of leucine, 1 of oxamine, 4 of glycocoll, and 4 of alamine, to 4,000 parts of soil. Pots filled with the prepared soil were sown with cress, monkshood, and basil, and, after the young plants had produced a few leaves, were covered hermetically with bell glasses which also contained baryta for the purpose of absorbing any carbonic acid that might be present.

The height of the plants and the number of their leaves was tripled or quadrupled in a few weeks, but other plants inclosed in bell glasses without the addition of organic amides to the soil failed to develop and soon died.

This experiment proves that green plants can produce the albumen of protoplasm from amides contained in the soil. To determine whether this power, like that of forming starch from atmospheric carbonic acid, is dependent upon the action of light on chlorophyl, Lefevre exposed one glass-inclosed pot of cress to bright diffused daylight and covered another with a thick black cloth. The plants in the second pot not only withered, but suffered a slight loss in dry weight, while the plants in the first pot grew rapidly. In one of the experiments the average dry weight of a seedling, in milligrammes, was 13.5 before the air was excluded, 30 after three weeks' exposure to light under the bell glass and only 10 after eight days of darkness under glass. Hence it is evident that the synthesis of protoplasm from amides contained in the soil is performed only in light, apparently through the agency of chlorophyl.—La Science au XXme Siècle.

Aeronautical Notes.

TESTS OF OUR NEW GOVERNMENT DIRIGIBLE.

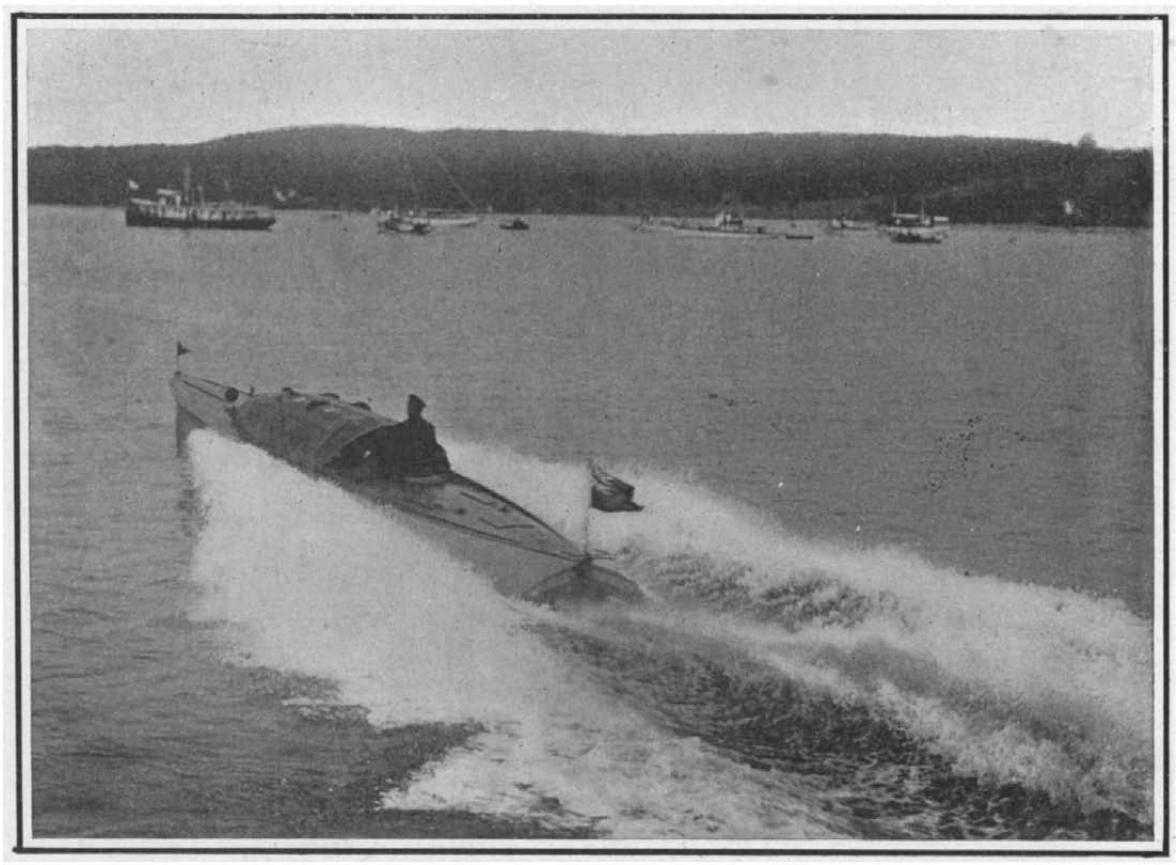
Last week, at Fort Myer, near Washington, D. C., Capt. Thomas A. Baldwin began experiments with the new dirigible which he has constructed for the Signal Corps of our army. The preliminary tests were quite successful, the combined horizontal and vertical plane rudder at the rear, and the superimposed aeroplanes at the forward end for controlling the vertical movements of the dirigible, all being found to work satisfactorily. The only change found necessary was the increasing of the surface of the vertical rudder by about 30 per cent. The new airship carries two men, one of whom attends to the motor and operates the aeroplanes for the control of elevation, while the other toward the rear of the framework, steers. The motor is placed toward the forward end of the framework, and drives a single propeller located at that end. As the new dirigible, in a test made on August 7, showed its capability of traveling 20 miles an hour, Capt. Baldwin expected to make the first official trial flight the next day.

THE WRIGHT BROTHERS' EXPERIMENTS.

As we go to press, word comes from France that Wilbur Wright has his aeroplane at the race track near Le Mans, and that he expects to make a flight of 50 kilometers or more, almost any day. Orville Wright, we understand, will arrive at Fort Myer by the 15th instant, and begin his trials with the aeroplane which he has built for our government.

CONTEST FOR THE SCIENTIFIC AMERICAN TROPHY.

The contest committee of the Aero Club of America have decided to hold a contest for the SCIENTIFIC AMERICAN Trophy in the vicinity of New York city on Labor Day (September 7). The distance to be covered is 25 kilometers (15½ miles) in a closed circuit. If there are several competitors, the one that makes the longest flight of over 25 kilometers will probably be declared the winner. The test will not be for distance alone, however, as stability, speed, and ease of control will also be considered. It is hoped that Mr. Farman will be able to meet the Wright brothers in open competition upon this occasion, as it will give him an opportunity to show what his machine is capable of doing, which was by no means the case in the recent short flights he made at Brighton Beach race track.



The "Wolseley-Siddeley," the English Contestant, Which Finished Second in 1 Hour, 5 Minutes, and 46 Seconds. She Had About Twice the Horse-Power of the Winning American Boat.

THE INTERNATIONAL MOTOR BOAT RACE FOR THE HARMSWORTH TROPHY.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

CORSET.—H. H. TREFFER, Davenport, Iowa. The corset has a closed, adjustable, and ventilating back, the lacing being in front, so that the corset may be glove-fitting and drawn tight without a tendency to move upward or downward, remaining while worn at all times and under all conditions where it properly belongs. The corset is cut so that no matter how loose or tight it is drawn over the hips, perfect comfort at such points is obtained, and the abdomen comfortably sustained and kept from protruding, giving the figure perfect pose and natural position.

RETAINING-COMB.—I. O. LOFSTROM, Selby, Cal. In this patent the invention relates to an improved retaining comb, commonly known as side and back combs, for the hair, the object of the inventor being the provision of a device of this character which will hold the hair more firmly than combs heretofore in use.

SLEEVE-HOLDER.—M. KUZE, New York, N. Y. In this instance the improvement has reference to holders for sleeves, hose, and the like, the more particular object being to provide a holder admitting of a considerable variety of uses and possessing certain constructional advantages such for instance as the shortening and holding the sleeve firmly in position.

Electrical Devices.

MAGNETO-ELECTRIC GENERATOR. — L. A. GIANOLI, 26 Boulevard Magenta, Paris, and R. A. PERSIN, Rue d'Aval, Villiers-le-Bel, Seine et Oise, France. The object of the invention is a machine characterized by the combination with the rotating secondary of a vibrator or breaker having a retarded action, the breaker being carried by the secondary, and being intercalated in the primary circuit, and breaking the primary circuit, when the intensity of the magnetism on the core of the secondary attains a suitable value.

Of General Interest.

HUMIDIFIER.—H. C. TOWNSEND, Anderson, S. C. The improvement made is in humidifiers, such as used in cotton factories for moistening the air. The opening between the cover tube and air flue is so large that the air from the flue will blow out all trash or lint, and the lifting of the cover tube is all that is necessary to clean the humidifier, while with the devices in common use it is necessary to pick the lint out with small pins and other means. The construction is simple, easily operated, and cheaply made.

FOUNTAIN-BRUSH.—J. SABOURIN, Globe, Ariz. Ter. In operation, the brush will be sealed so that none of its contents can escape. If, however, the cover be removed the contents of the body or holder may escape to the brush and the latter be utilized for spreading the material after the manner common in brushes of this general class. It may be securely sealed and readily brought into play for use whenever desired.

METHOD OF ORNAMENTING FUR-SKINS.—T. RASMUS. New York, N. Y. The purpose here is to provide means whereby the badger hairs that are inserted as tips in artificial black fox and lynx furs will appear white at their outer ends only, the remaining portions of the inserted hairs being of the same color as that of the fur of the skin, so that while white tips will appear at the surface when the fur is blown aside, the inserted hairs cannot be distinguished from the fur, thus giving a natural appearance to the skin.

SHAVING-MIRROR.—F. E. NEUMANN, New York, N. Y. More particularly the invention refers to means for readily adjusting a mirror to different elevations and simultaneously adjusting the positions of the lights whereby the mirror is illuminated. The mirror and its accompanying parts may be readily folded and packed away.

VENTILATOR.—C. EISENSCHMID, New York, N. Y. This invention relates more particularly to that type of ventilator commonly employed above the roofs of buildings, for permitting the escape of foul air. It relates especially to means for supporting and operating the damper or valves, and involves the use of a longitudinally-movable rod supported in guides at opposite ends thereof and having the damper or valve secured to the rod intermediate the guides.

FABRIC-PRESSING DEVICE.—E. J. DAVIS, Prosser, Wash. The purpose in this instance is to provide details of construction for a press that may be embodied with a trunk or suit case, and afford compact, convenient, and reliable means for pressing the legs of trousers, to remove wrinkles therefrom, and also crease them in conventional style; the device being also available for pressing other garments or fabric if desired.

KILN APPARATUS.—W. T. BLACK, Laquin, Pa. The apparatus is particularly useful in connection with kilns, sheds, and other structures for drying and seasoning wood. One object of the invention is to provide a charging car having means for firmly and resiliently holding the material to be dried, and guides for assisting in loading the car with the material to be used. The loading device used is covered in a patent application formerly filed by Mr. Black.

BURGLAR-ALARM.—L. B. HANCOCK, Richmond, and W. J. STERLING, Portsmouth, Va. By this invention an alarm is provided having a main frame composed of a plate of metal bent to form a cartridge holder, a fiange whereby the frame may be secured to a suitable support and having a guide in which the hammer operates together with a spring for actuating the hammer and a trigger for holding and releasing the hammer.

BURGLAR-ALARM.—J. H. BROWN, New York, N. Y. This device is designed to automatically retract or cock a trigger by the closing of the door and release the trigger when the door is opened and thereby explode the cartridge. Means hold the trigger in retracted position on opening the door, operable with a key from the outside of the door, and means render the alarm altogether inactive when the door is moved to and from a closed position.

RACK.—G. H. SCHUBERT, Reno, Nev. The invention is an improved rack, more especially intended for phonograph records, and has in view such a device that will display the ends of the cartons in which the records are kept, whereby the record wanted may be readily selected; also a construction by which the capacity of the rack may be increased as the selection of records is added to.

APPARATUS FOR OIL-WELLS. — L. W. BROWN, Bakersfield, Cal. The apparatus separates and saves the oil from the dredgings, and saves such oil as leaks around the stuffing-box and the upper portion of the well-casing. A large amount of oil goes to waste by the discarding of the dredgings or sludge, which is principally composed of oil and sand. This may be avoided, the invention embodying a separating tank for the separation of the oil from the sand preparatory to passing the sludge to the dump.

Hardware.

WRENCH.—F. W. NOTT, Bluefield, W. Va. In this invention the improvement is in wrenches. The movable jaw is slidable on the handle and has a limited movement transversely thereof. Since the pawl is rigid with respect to the movable jaw, a movement of the jaw will move the pawl into and out of engagement with the teeth.

BUCKLE.—R. LONDON, New York, N. Y. The object of the inventor is to provide a buckle arranged to allow ready insertion of the strap, to render the retaining teeth for the strap on the buckle invisible, and to allow convenient fastening of the buckle to the garment or article. It relates to buckles for use on knee pants and other garments and articles, as shown and described in the application for Letters Patent formerly filed by Mr. London.

HORSESHOE. — S. GORDON, Washington, D. C. The horseshoe is one of little cost and may be made in varying sizes and so constructed as to prevent slipping on icy or slippery pavements, and is formed of one piece of malleable iron or steel and is provided with three sets of calks of different elevations. Any form of pad may be used in connection with the shoe.

DETACHABLE HORSESHOE.—T. P. SCULLY, Rome, N. Y. This detachable shoe is arranged to preserve the animal's hoof to the fullest extent, and to permit of conveniently placing the wearing member in position on a permanent member or for removing the wearing member of the shoe when the calks are dull or worn out or broken, to permit of removing the calks and replacing the wearing member.

Household Utilities.

COVER-OPENING DEVICE.—T. P. SCULLY, Rome, N. Y. The invention refers to devices for automatically removing and closing the covers or the like from cans, pails, barrels, and kettles and other receptacles. The object is to provide a device arranged to automatically swing the cover into an open position on swinging the bail from a vertical carrying position downward, and to return the cover to a closed position on bringing the bail upward into a carrying position.

FOLDING BED.—A. PIASER, New York, N. Y. The bed can be quickly and easily extended for use, and can be folded into a small and compact form. The parts, when the bed is extended, are securely locked against accidental movement, and the weight of the user acts to hold the parts in position. The folding sections are locked against casual movement when in an operative or extended position, and certain of which are also locked against accidental displacement when in a folded position.

HIGH-PRESSURE STEAM AND WATER COOKER.—W. GRAY, Lincoln, Neb. In carrying out this invention a form of apparatus is provided that will enable the cooking to be done without adding to the amount of water first placed in the vessel with the food and without decreasing the amount of liquid by excessive evaporation, the relative proportion of the liquid to the solid matter remaining approximately the same throughout the operation, and no more being present in the vessel at the end than at the commencement.

COVER.—F. ESSMULLER, New York, N. Y. The object of the improvement is to provide a cover for use on bowls, jars, tumblers, and like household and culinary vessels, and arranged to fit the mouth of various vessels of different sizes, and to securely hold the cover in place against accidental displacement.

KITCHEN-CABINET.—H. HARRILD and G. R. HARRILD, Spokane, Wash. In the operation of the cabinet when the top is lowered the parts are in position where the supporting arms are lowered and the work-board is dropped out of the way of the parts on the under side of the top. If now the top be raised and thrown back the supporting arms will be rocked to a position that gradually lifts the work-board to the desired height, and the supporting board may then be lifted to a position in which it will form a firm support for the front end of the work-board.

Machines and Mechanical Devices.

PHOTOGRAPHIC DEVICE.—G. W. STEPHENSON, Oklahoma, Okla. In operation, the record to be copied is placed upon a support, and the reflecting medium is adjusted to reflect the image on the sensitized paper at the rear of the bellows. After exposure, the shaft is oscillated to bring the fingers of the receiving device into position, after which the roller carrying the feed disks is rotated one turn, thus moving the strip of paper downwardly so that the exposed portion passes between the series of fingers; the knife severs the strip, and the shaft is rotated to lower the strip into the developing solution. Means provide for receiving the strip from the feeding device.

SACK-FILLING APPARATUS. — C. E. KEERAN, Harrington, Wash. The invention relates to filling apparatus, and more especially to such as are used in filling sacks, bags, and the like with granular or loose material. In operation, the clutch is thrown into engagement with the driving pulley and the crank shaft is thereby put in motion. As the shaft rotates it reciprocates the frames by means of the cranks and connecting parts, and thereby agitates the receptacles.

BELT-STRETCHER.—P. E. CHASE, Coeur d'Alene, Idaho. The object of this invention is to provide a belt stretcher for stretching a belt for re-lacing or other purposes, and which stretcher is simple and durable in construction, arranged for convenient attachment to the belt and for drawing the ends up evenly and securely locking the stretcher in the adjusted position, thus holding the belt in the stretched condition for lacing.

DOOR CHECK AND CLOSER.—J. FAIRHALL, JR., Danville, Ill. The invention is particularly useful in connection with sliding doors for electric and other elevators. An object is to provide a check and closer, by means of which a door when opened can be automatically returned to its shut position, positively and substantially silently. The sliding door can be automatically closed firmly and with a minimum of noise and the door opened with expenditure of little effort.

THREADING DEVICE FOR SEWING-MACHINES.—S. B. BATTEY, New York, N. Y. The principal object of the invention is to provide a device arranged to draw the needle thread through the eye of the needle at the time the latter is in its uppermost position. A further object is to provide for the operation of the device either automatically or by hand, and to automatically throw it out of operation by the movement of a part of the machine when operated by hand.

MORTISING AND GROOVING MACHINE.—L. LUBIN, 21 Rue Martissot, Clichy, Seine, France. The present invention relates to mortising and grooving machines, and particularly to the arrangement of the tool holder shaft or of work holder carriage, the section of which is constituted by two parallels united by two semi-circumferences. It is applicable to both wood working and to the working of metals or any other materials.

Prime Movers and Their Accessories.

EXPLOSIVE-ENGINE. — C. E. GOODRICH, Daggett, Cal. The object of the invention is the provision of a new and improved explosion engine of the internal combustion type, and arranged to give two impulses to the reciprocating piston for every revolution of the main shaft, and to insure utilizing of the explosive charge to the fullest advantage.

Railways and Their Accessories.

AUXILIARY DOME FOR STEAM-BOILERS.—J. SHELTON, Knoxville, Tenn. In railroad accidents, many are injured by escaping steam or hot water, and the inventor's object is to automatically shut off the steam in accidents from all parts of the train. The improvement will be of great utility in replacing valves or pipes or other parts through which steam passes without killing the engine. It is also applicable to stationary boilers as well as to locomotives.

Pertaining to Vehicles.

POWER TRANSMISSION.—J. L. WILLIAMS, Ellzey, Fla. The object of the invention is to provide a power transmission, arranged to drive the vehicle wheels of automobiles and other power-driven vehicles forward or backward, and to allow the driven wheels of the front or rear axle to turn independently one of the other when steering the machine around corners, thus relieving the driving shaft of all undue strain.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

HINTS TO CORRESPONDENTS.

Full hints to correspondents were printed at the head of this column in the issue of August 8th, or will be sent by mail on request.

(10826) G. G. K. asks: Would be pleased to have you answer this question: I wish to protect a house from lightning; house is roofed with shingles. It has a metal ridge board on the peak made from galvanized sheet steel strips 4 feet long and 11 inches wide, each strip extending over the last strip a few inches and all nailed to the roof. By placing points on this metallic ridge board and giving a good ground connection at two places so as to make a complete circuit over the building, would this give good protection from lightning? Please answer in Notes and Queries. A. The sheet metal ridge of your roof will be a very good starting point for a lightning rod. We should advise that you use heavy galvanized telegraph wire for the ground lines and run them down the edges of the roof so as to have all edges provided with a wire. Then make a good earth connection and you will be as well protected as possible. Points may be put on the ridge also.

(10827) A. W. asks: Please give the formula for estimating cost per hour for a 16-candle-power incandescent lamp on a 110-volt, 5-ampere circuit, rate 15 cents per kilowatt per month. A. A 16-candle-power lamp may be taken to use 55 watts per hour. Multiply this number by the number of hours it is in use per month and divide by 1,000, and you will have the kilowatts used in a month.

(10828) F. A. McC. asks: Is there a method by which any angle can be trisected? If not, is there any prize for the person who successfully trisects one by geometrical constructions, and proves the operation to be correct? What is meant by "squaring the circle"? A. There is no method by which every possible angle may be trisected, but there are plenty of methods by which some angles may be trisected. Indeed, the number of angles which may be trisected is quite large. There is no prize to be won for trisecting angles. The matter is well understood by mathematicians, and no longer excites interest even. To "square the circle" one must find the side of a square which has the same area as a given circle. This it is impossible to find. The area of a circle is 3.141592 times the square of the radius. As this number can never be found with exactness, the area of a circle and the side of the equivalent square can never be found with exactness. Any desired degree of approximation can be had by carrying the number given above to a greater or lesser number of decimal places. It has been computed to several hundred figures.

(10829) O. C. S. asks: 1. How nearly can astronomers tell the exact time? A. Time may be determined with ease to the hundredth of a second, and very closely to the thousandth of a second. The position of stars and the bodies of the solar system may be known to the same exactness. 2. How nearly can they tell the time of a coming eclipse? A week ahead? A month ahead? A year ahead? Ten years ahead? A. Eclipses are calculated to any desired time ahead. They occur with regularity in a cycle of 18 years 11 1-3 days. Hence it is a simple matter to determine the return of any particular eclipse. The tables are given in the nautical almanacs for each year. These books appear several years in advance. 3. Why is it that jewelers' clocks vary so much, even when regulated hourly by electricity transmitted over the telegraph wires? Are all the W. U. T. clocks of any given city set from the same source, and if so why do they vary two or three minutes? A. Clocks which are intended to be kept together will keep together if properly cared for. If any clocks which you know do not do so, it is because somebody does not do his work properly.

(10830) G. A. H. asks: Would you kindly inform me through your Notes and Queries the following things with regard to the earth: 1. Assuming that the earth's polar radius is thirteen miles shorter than its equatorial radius, the depression for each mile that you go north is approximately ten feet. Why is it not necessary to make allowance for this in running levels? 2. It is stated that the Mississippi flows up hill on account of the centrifugal force of the earth. There are probably places where it does not descend ten feet a mile, but are there any places where it is below sea-level? 3. Is not sea level at the poles about thirteen miles nearer the center of the earth than it is at the equator? A. Sea level is the level of still water on the earth. It takes into consideration all the conditions of the case as to centrifugal force, and any other disturbing cause whatever. This being the definition of a level, it follows that there are no rivers of the earth which run "up hill," as is so often stated in popular periodicals. In surveying for any extensive work, it is necessary to take account of the departure of the surface of the earth from an optical level or plane surface. It is always done in surveying for water works and the like, else the water

would not follow the ways laid out for it. It is not true that the earth curves from a level ten feet in any one mile, as you calculate it to do. The curvature is 8 inches for one mile and 32 inches for two miles. It is true, however, that the surface of the earth is 13 miles nearer the center of the earth at the poles than it is at the equator.

NEW BOOKS, ETC.

LLOYD'S REGISTER OF AMERICAN YACHTS. A List of the Yachts, Yacht Clubs, and Yachtsmen of the United States, the Dominion of Canada, and the West Indies. New York: Lloyd's Register of Shipping, 17 Battery Place. 1908. 8vo.; pp. 454. Price, $7.50.

The sixth annual volume of Lloyd's Register of American Yachts for 1908 is now ready for delivery to subscribers. The book, which shows a material increase in size over last year, has been thoroughly revised in all particulars; specially in those relating to the engines of the rapidly-growing fleet of cruising launches. There is listed a total of 3,670 yachts, both sail and power, owned in the United States, Canada, and the West Indies, with a total of some 3,500 yacht owners. The color plates give 2,013 private signals of American yachtsmen and the burgees of 365 yacht clubs. One of the most interesting features of the book, as showing the growth of American yachting, is the list of yacht clubs. The first American Yacht List, published in 1874 by the late Neils Olsen, listed a total of 32 yacht clubs, and the greatest number listed prior to the establishment of Lloyd's Register of American Yachts was about 170. Lloyd's club list has grown steadily since 1903 until it has now reached a total of 386 clubs, distributed in all parts of the United States and British North America. Not a few of these clubs have been established during the past winter. This great increase is made up in three ways: first, of yacht clubs established in new localities; second, of new clubs established to meet the recent growth of the sport in localities where many clubs already exist; and the third class of clubs, a large one distributed in all parts of the country, is made up of the so-called "power boat," "motor boat," and "launch" clubs. As many of these clubs are located on narrow inland waters where sailing is out of the question, they appeal to an entirely new class, from which in the future the ranks of American yachtsmen will be largely recruited.

THE CHILDREN'S BOOK OF STARS. By G. E. Mitton. New York: Macmillan & Co., 1908. Small square demy 8vo.; 16 full-page illustrations and 12 diagrams. Price, $2.

The book which lies before us is a sincere attempt to place before children in the simplest possible form the elementary facts of astronomy. In the main the author has succeeded admirably, although it must be confessed that technical phraseology has not been so thoroughly eliminated as it might have been, largely because of the very nature of the subject. A good chapter on the use of the spectroscope tells with remarkable simplicity "What Stars Are Made Of," and shows that it is possible to present plainly the main facts of one of the most difficult branches of modern astronomy. On page 169 appears an error in describing the spectra of the sun and Sirius, the star Arcturus being incorrectly given instead of Sirius. The general arrangement of the book is that usually adopted in works on astronomy. It proceeds in the order of the earth, moon, planets, sun, comets, meteors, constellations, stars, and nebulæ.

PRACTICAL PERSPECTIVE. By Frank Richards and Fred H. Colvin. Third edition. New York: The Norman W. Henley Publishing Company, 1908. 12mo.; cloth; 56 pages; 62 illustrations. Price, 50 cents.

Mr. Richards explains the principles of isometric perspective and shows several of its applications to machine work. The other treatise is on the use of isometric paper, written by Mr. Colvin. The scheme of this important little book is to show how to make all kinds of mechanical drawings by the isometric method and adding practical examples of various classes of work.

THE REFRIGERATING ENGINEER'S POCKET MANUAL. An Indispensable Companion for Every Engineer and Student Interested in Mechanical Refrigeration. By Oswald Gueth, M.E., Mem. Am. Soc. Refr. Engrs. New York, 1908. 12mo.; cloth; illustrated; 156 pages. Price, $1.50.

The practical experience of the author as an engineer has enabled him to give a digest of rules and data of every branch of mechanical refrigeration. In this work he has made use of the opinions held by the leading experts. The field covered comprises Principles and Properties; Refrigerating Machinery; Applications for Mechanical Refrigeration; Operation of Compression Plant; and the Steam Plant. The subdivisions of these parts take the inquirer into a very clear arrangement of subjects which are thoroughly illustrated with diagrams of apparatus, plans, systems, machines, engines, plants, etc., and these are supplied with extensive tables of scales, dimensions, trials, tests, measures, powers, and capacities.

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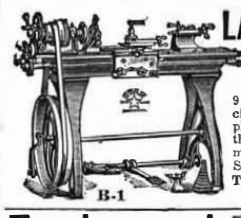

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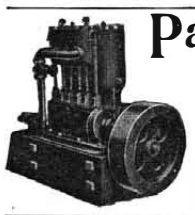

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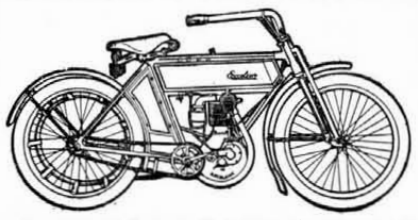

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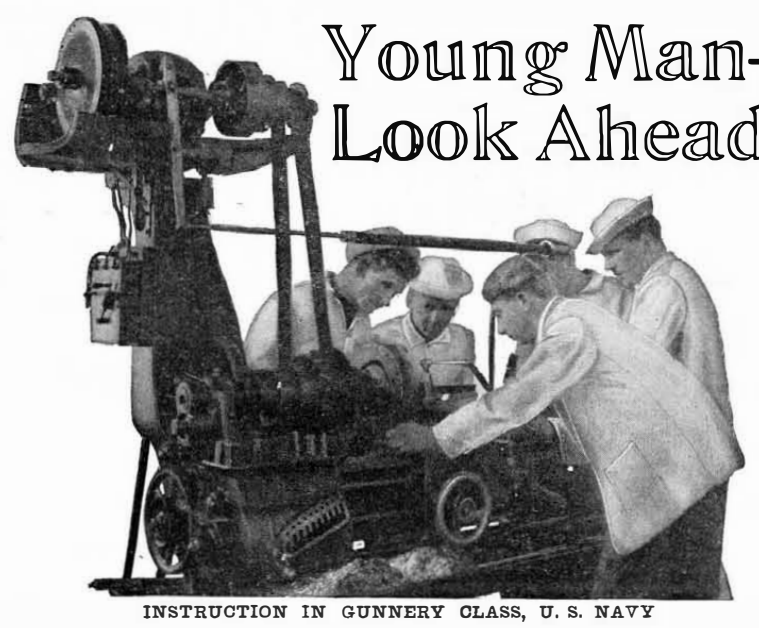

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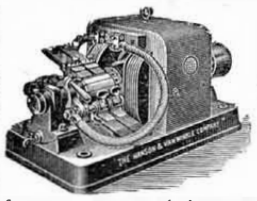

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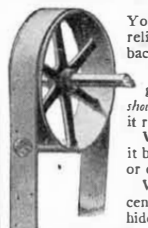

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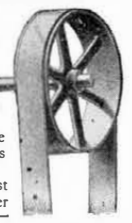

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mean so much on a belt. We can't tell you all the others here, but write us and we'll go into details and advise you what size and ply belt will do your work most effectively.
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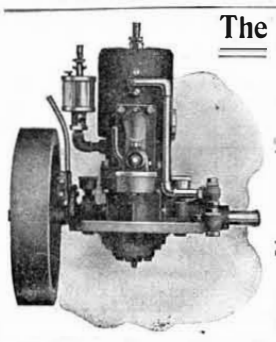

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